09 - MEDIUM FREQUENCY ELECTROTHERAPY IN THE MUSCLE STRENGTH

SEBASTIANA DA COSTA FIGUEIREDO; LAÍS GALVÃO LEMOS SANTANA; ROBERTA DE SOUZA REBEQUI;
DANIEL ROGERIO DE MATOS JORGE FERREIRA; ERICO CHAGAS CAPERUTO; MARCELO FERNANDES;
DENISE LOUREIRO VIANNA; GISELA ROSA FRANCO SALERNO;
CARLOS ALBERTO DOS SANTOS; ALEXANDRE SABBAG DA SILVA;
UNIVERSIDADE PRESBITERIANA MACKENZIE – SÃO PAULO - SP – BRASIL
ftale.sabbag@gmail.com

doi:10.16887/89.a1.9

Introduction

By definition, surface neuromuscular electrical stimulation (NMES) is the use of an external controlled electrical current applied to the skin surface trough proper electrodes with the objective to stimulate a specific muscle or muscle group and/or its nervous terminals producing a muscle contraction. (MAFFIULETTI, 2000; GREGORY; BICKEL, 2005).

Electrical stimulation in muscle strength training had its breakthrough through the research of the Russian scientist Yakov Kots in the mid-1970s. He was the first to use a medium-frequency alternating current for muscle strengthening. In his research, he stimulated muscle groups of athletes and healthy individuals. He concluded that direct stimulation of the muscle at a frequency of 2500 Hz was the least uncomfortable and of the greatest contraction. Since then, this medium frequency of neuromuscular electrical stimulation (NMES) has gained the name of Russian Current (CR). (DELITTO, 2002; WARD; SHKURATOVA, 2002).

The Aussie current was developed by Alex Ward of the University of LaTrobe in Melbourne, Australia, and is an alternating therapeutic electric current with a carrier frequency in the kHz range and modulation at low frequency with some similarity to interferential therapy and Russian current; the difference is in the value of the kHz current used as well as in the waveform. For muscular contraction, the Aussie current uses a frequency of 1 kHz combined with a burst of 2 milliseconds duration, thus, the production of torque is maximum when compared to other commercial currents. (WARD et al., 2004).

The evaluation of muscle strength in a simple and objective way composes an icon necessary for Physiotherapists in order to obtain clinical-scientific information and to draw a diagnosis and the use of portable dynamometer emerged as an alternative and low cost, consolidating in the research. (ROBINSON; NEE, 2007; MARQUES et al. 2010)

This study aimed to evaluate the muscle strength acquired after the application of a NMES protocol by two medium-frequency currents (Russian and Aussie Current) using a portable dynamometer and compare the results in an isolated way in the triceps brachii of no active women, demonstrating the evolution of the muscle in a quantitative form.

Materials and Methods

Fifteen women, healthy, without comorbidities, with a body mass index (BMI) ranging from 18.5 to 24.9 kg / m², considered as normal weight according to the Ministry of Health, and aged between 18 and 27 years, were selected.

Participants were selected by convenience trough a verbal invitation. Then they participated in a meeting where all the details of the study were clarified, including risks and benefits. Right after that they received an informed free consent form to be to which they should agree and sign. All experimental procedures of this study were approved by the UNG ethical committee by the protocol number 73918817.0.0000.5506. Participants were excluded if they had history of previous regular physical activity or resistance training with the goal of muscular training in the last 6 months as well as during the period of the study, also if they were obese or present any associated disease, such as diabetes, high blood pressure and co-related diseases. They were also excluded if they presented any trauma or orthopedic problems in the upper limbs that would interfere with the test performance (contusions, sprains, tendinitis, bursitis, etc) and if they refused to take part in the study.

The Aussie current was applied using the Neurodyn Aussie Sport device manufactured by IBRAMED LTDA®, which has an alternating biphasic medium-frequency current with sinusoidal pulse and the Russian current was performed using the Endophasys-R® model VMDNS: 16-255, manufactured by KLD Biosistemas Equipamentos Electrónicos LTDA®, that has an alternating biphasic current of average frequency with sine pulse.

Initially the participants filled a personal data questionnaire with information on their age, and dominance of the upper limbs, right after that, they were weighted in a Filizola® scale (Personal line model) and their height was measured using a TBW® stadiometer. From these measures we calculated BMI (weight divided by height, in centimeters, squared).

Then, participants were evaluated regarding the elbow extensors muscles force from the dominant and non-dominant upper limb using a digital dynamometer (Lafayette manual muscle tester), this evaluation was carried out by somebody from the research team that was not related to this study.

The methodology used to evaluate muscle force was described by Marques et al., (2010). The participants laid in a stretcher in supine position, with their upper member positioned with the shoulder abducted to 30o, the elbow flexed to 90o and the forearm supine. During the test, the device was put in the back of the distal portion of the forearm. The researcher applied a force in the opposite direction of the elbow extension movement of the participants, after the verbal command of the researcher they exerted a gradual force until they reach their maximal contraction of the elbow extension that should last 5 seconds. The test was repeated 3 times with 2 minutes of interval between them. The maximum peak value was used as reference in each test and an average of them was made. This procedure was done before and after the NMES protocol. Two days after the force evaluation the NMES protocol started.

The parameters used in this study were, Russian current of 2.500 Hz, modulated frequency of 50Hz, cycle phase of 50%. The stimulation with the Aussie Current was current carrying 1000 Hz, modulated frequency of 50 Hz, burst of 2 milliseconds. Both currents had the contraction time (ON) set to 20 seconds and rest (OFF) set to 20 seconds, ramp-up and ramp-down of 2 seconds and intensity enough to produce a muscle contraction up to the participant tolerance level, without causing any pain. The participants were instructed not to voluntarily contract the muscle along with the current stimulus, so we could evaluate the sole effect of the treatment in the muscle force gain. The whole procedure lasted 20 minutes.

The participants had the triceps muscle belly cleaned with a piece of cotton soaked in ethylic alcohol to assure the fixation of the electrode pads. They were seated with their knees flexed and the 5x9 self-adhesive electrodes were placed close to the origin and insertion of the stimulated muscle. The muscle that had more strength (measured previously) was not stimulated and served as a control. Current intensity was increased 3 times in intervals of 5 minutes, respecting the participant tolerance, so it could reach the strongest and visible muscle contraction during the entire protocol time, and avoiding that the current would accommodate.

Statistical Analysis

Data was tabulated to the SPSS program and presented as a table. The pre and post data were analyzed using the paired T test, between groups data were analyzed using Student T test with significance set to p<0.05.

.

Results

Data from demographic data such as age and anthropometric variables are expressed in table 1.

Table 1. Distribution of participants' frequency according to age, weight, height and BMI.

	Russian Current M (DP)	Aussie Current M (DP)
Age (Years)	20,0 (1,6)	20,1 (1,3)
Body mass (Kg)	51,5 (4,6)	56,7 (5,3)
Height (m)	1,60 (0,04)	1,62 (0,08)
BMI (kg/m²)	19,8 (2,0)	21,5 (0,9)

The results showed that there was an increase in muscle strength in both arms, with the mean gain in Aussie current group elbow extensors stimulated of 10.5 pounds and in the group of the Russian current of 14.5 pounds, being these, statistically significant. (Table 2)

Table 2. Mean and standard deviation of subjects muscle strength (lbs) submitted to NMES measured with portable dynamometer in the pre-test and post-test intragroup comparison of the control and test arm and P. value

Russian current				
Test arm	23,9(6,5)	38,4(9,2)	14,5(3,5)	P<0,001*
Control arm	27,8(7,5)	32,9(4,8)	5,1(4,3)	0,017*
Aussie current				
Test arm	32,0(6,1)	42,5(4,7)	10,5(5,3)	P<0,001*
Control arm	35,3(5,9)	38,8(4,7)	3,5(4,2)	0,035*

Table 3 shows that the Aussie current group presented a superior force in the pre-test in both the test and control arm; after the application of the currents there was no significant difference by the currents and when the variation (Δ = post and pre) by the currents was evaluated, there was no difference in the force gain by the two currents evaluated in the test and control arm.

Table 3. Mean, standard deviation and muscle strength (lbs) of participants submitted to NMES measured with portable dynamometer in the pre-test and post-test of the control and test arm and P. value

	Russian Current N=8 M(dp)	Aussie Current N=9 M(dp)	P
Pre arm test	23,9(6,5)	32,0(6,1)	0,019*
Pre arm control	27,8(7,5)	35,3(5,9)	0,038*
Post arm test	38,4(9,2)	42,5(4,7)	0,257
Post arm control	32,9(4,8)	38,8(4,7)	0,023*
Δ arm test	14,5(3,5)	10,5(5,3)	0,105
Δ arm control	5,1(4,3)	3,5(4,2)	0,486

Subtitle: Δ – delta (variation)

The intensity of the current supported by the volunteers ranged from the first to the last week, increasing the value in the two groups studied. It was verified in the group stimulated with the Russian current, higher intensities supported in the course of the study.

Discussion

The interest in EENM for gains in muscular strength began in the 1970s through published works on the medium frequency current (2,500 Hz) by Soviet researcher Yakov Kots in a Russian Olympic team associated with classical training. Kots has advocated a work regimen for increased muscle strength that can increase the maximum voluntary contraction with much success of elite athletes by up to 40%. (DELITTO, 2002; WARD; SHKURATOVA, 2002).

The Aussie or Australian current developed by the researcher Alex Ward began as a therapeutic modality that promotes electrically induced muscle contraction causing less sensorial discomfort. The initial studies were conducted in the research laboratory of La Trobe University in Australia in the 1990s. The research was directed to the application of stimulation protocols in healthy individuals of both sexes to verify the optimal median frequency ranging from 1Khz to 35Khz involving pain tolerance, sensory discomfort and movement torque. (WARD; TOUMBOUROU, 2007).

Ward et al., (2006) compared the magnitude of torque and the level of discomfort elicited by four types of current, two low-frequency (single-phase pulsed) and two medium-frequency (Russian and Aussie). The Aussie current (1 kHz modulated in bursts of 50 Hz, burst duration of 4 ms and interburst interval of 16 ms) was the most comfortable of the currents analyzed, produced torque values similar to the low frequency currents, and significantly higher torque than the Russian current. In addition, the results showed that there was no significant difference between the sensorial discomfort caused by the different types of current. Thus, the authors concluded that the type of current (low or medium frequency) seems not to depend on the comfort factor to induce greater joint torque, but on other variables that require more scientific investigation.

Dantas et al., (2015) compared two medium frequency currents (Russian and Australian) with a low frequency one. The Australian current was modulated with frequency of 1 KHz, burst with 4 ms of duration, interbust interval of 16 ms and phase duration of 500 μs; the Russian with a frequency of 2.5 KHz, a burst and an interbust interval of 10 ms with a phase duration of 200 μs, and the pulsed currents with a phase duration of 500 μs and 200 μs. All currents were modulated with a 50 Hz pulse / burst frequency. Their results showed that the currents had similar level of discomfort, however, the Russian current evoked less torque than the others, and there was no significant difference in the magnitude of the torque evoked by low frequency currents and Australian.

Most of the studies evaluated the low compared to the mean frequency of NMES. (GUIRRO et al., 2000; SOARES et al. 2002; DA SILVA et al., 2015; VAZ; FRASSON, 2018). A few studies compared the gain of muscle strength after an NMES protocol of mean at 2500 Hz and 1000 Hz. The few studies investigated the torque promoted with the NMES comparing both and demonstrated an advantage for the carrier current of 1000 Hz. (WARD et al., 2006 DANTAS et al. 2015) Theoretically, the capacity to generate more torque during the contractions associated with NMES would result in a greater gain of muscular strength after a certain period, however, this data was not observed in the present study, since both medium frequency currents after 5 weeks of protocol, presented similar results in the muscular strength gain.

A finding has been previously reported in the discussion by Guirro et al. (2000) regarding the previous strength of the volunteers interfering in the results after NMES. This data was also observed in this study. The work of Soares et al. (2002) although did not report in his findings, also presented in the group stimulated by the Russian Current a lower force than the group stimulated with low frequency.

In this study, the groups were randomized and later the strength of the volunteers was evaluated, which showed a significant difference of average strength by the groups, being of 23.9 pounds in the Russian Current group and 32.0 pounds in the Aussie group , before the beginning of the NMES protocol, and this fact could have been decisive in the final result of the research.

Some authors have reported in research that current modulated at a frequency of 50 Hz produces better results in increasing muscle strength. (GUIRRO et al., 2000; MARQUES et al., 2002; LAUFER; ELBOIM, 2008). In the present study, the modulated carrier current was also used at a frequency of 50 Hz, which proved to be efficient in increasing the muscle strength of the elbow extensors after the application period.

In relation to the intensity of the current, the participants were encouraged during the research period to use high levels of tolerable intensity because there is a linear relationship between the increase of the force and the current intensity applied. (MARQUES et al., 2002; GODIN et al., 2011; VAZ; FRASSON, 2018).

A fact observed during the execution of the protocol, which caught attention, was that during the days, the intensity showed successive increases; at the end of the study, all the volunteers presented levels of intensity superior to the one reached in the beginning. Similar data were presented in other studies. (GUIRRO et al., 2000; MARQUES et al., 2002).

Factors that may be related to strength gain are that electrically induced stimulation activates a greater number of motor units than an individual could voluntarily activate. The NMES is a therapeutic technique capable of generating neural adaptations and in the myofibrillar structure that cause implements in muscle strength. (GONDIN et al., 2011; HORTOBAGYI; MAFFÍULETTI, 2011)). Chronically, training with NMES modifies gene expression, leading to changes in the muscle fiber phenotype and induces an increase in the number of satellite cells, and the time and intensity of training are important factors that determine the efficacy of therapy. (THRASHER; POPOVIC, 2008; GONDIN et al., 2011; GUO et al., 2012; DURIGAN et al., 2014).

However, there are still some controversy in the literature regarding the proper patterns to be used with this type of stimulation. The electrically induced muscle fatigue is another negative element in the NMES protocols that has to be observed and evaluated during the current application, in order to minimize the damage that might occur.

The research showed significant increase in muscle strength with the use of this current alone, however, this fact still requires new scientific evidence due to the numerous situations that are visualized in the use of NMES. One of them is the divergences in the parameters used, corroborating with what has already been reported by other studies. (LAUFER et al., 2001; VAZ, FRASSON, 2018).

So it would like to point out the need of new research that would compare NMES of medium frequency in the muscle strength gain in healthy individuals and that the initial strength of the participants is measured before the randomization so the groups can be homogenous about this aspect.

Conclusion:

The results demonstrated that both Russian and Aussie currents was effective when applied isolated to increase muscle force in sedentary women, thus improving muscular performance and there was no statistically significant difference in the gain of force in the comparison between them. But the groups were different as to the force at the time pre-stimulation.

Referências

DA SILVA VZ, DURIGAN JL, ARENA R, DE NORONHA M, GURNEY B, CIPRIANO G JR. Current evidence demonstrates similar effects of kilohertz-frequency and low-frequency current on quadriceps evoked torque and discomfort in healthy individuals: a systematic review with meta-analysis. Physiother Theory Pract. 31 (8): 533-9, 2015.

DANTAS LO, VIEIRA A, SIQUEIRA AL Jr, SALVINI TF, DURIGAN JL. Comparison between the effects of 4 different electrical stimulation current waveforms on isometric knee extension torque and perceived discomfort in healthy women. Muscle Nerve. Jan; 51(1): 76-82, 2015.

DELITTO A. Introduction to “Russian electrical stimulation”: putting this perspective into perspective. Phys Ther. 82 (10): 1017-8, 2002.

DURIGAN JL, DELFINO GB, PEVIANI SM, RUSSO TL, RAMIREZ C, Da SILVA GOMES AD, et al. Neuromuscular electrical stimulation alters gene expression and delas quadríceps muscle atrophy of rats after anterior cruciate ligament transection. Muscle Nerve. 49 (1): 120 - 8, 2014.

GODIN J, COZZONE PJ, BENDAHAN D. Is high frequency neuromuscular electrical stimulation a suitable tool for muscle performance improvement in both healthy humans and athletes? Eur J Appl Physiol. 111 (10): 2473-87, 2011.

GONDIN J, BROCCA L, BELLINZONA E, D'ANTONA G, MAFFÍULETTI NA, MIOTTI D, et al. Neuromuscular electrical stimulation training induces atypical adaptations of the human skeletal muscle phenotype: a functional and proteomic analysis. J Appl Physiol. 110 (2): 433-50, 2011.

GREGORY CM, BICKEL CS. Recruitment Patterns in Human Skeletal Muscle During Electrical Stimulation. Phys Ther. 85: 358-364, 2005.

GUIRRO R, NUNES CV, DAVINI R. Comparação dos efeitos de dois protocolo de estimulação elétrica neuromuscular sobre a força muscular isométrica do quadríceps. Rev. Fisioterapia Universidade São Paulo, vol: 7, nº 1/2 pag: 10-5 dezembro, 2000.

GUO BS, CHEUNG KK, YEUNG SS, ZHANG BT, YEUNG EW. Electrical stimulation influences satellite cell proliferation and apoptosis in unloading - induced muscle atrophy in mice. PloS one. 7 (1): e30348, 2012.

HORTOBAGYI T, MAFFÍULETTI NA. Neural adaptations to electrical stimulation strength training. European jornal of applied physiology. 111 (10): 2439-49, 2011.

LAUFER Y, ELBOIM M. Effect of burst frequency and duration of kilohertz-frequency alternating currents and of low-frequency pulsed currents on strength of contraction, muscle fatigue, and perceived discomfort. Phys Ther. 88:1167–1176, 2008.

LAUFER Y, RIES JD, LEININGER PM, ALON G. Quadriceps femoris muscle torques and fatigue generated by neuromuscular electrical stimulation with three different waveforms. Phys Ther. Jul; 81 (7): 1307-16, 2001.

MAFFIULETTI NA. Physiological and methodological considerations for the use of neuromuscular electrical stimulation. Eur J Appl Physiol. 110: 223-34, 2000.

MARQUES MA, SANTOS CA, FREITAS STT, SILVA AS. Avaliação da força muscular dos flexores de cotovelo após estimulação elétrica neuromuscular. Revista Fisioterapia Ser. São Paulo, vol. 11, nº 2: p. 80- 84, 2010.

ROBINSON RL, NEE RJ. Analysis of hip strength in females seeking physical therapy treatment for unilateral patellofemoral pain syndrome. J Orthop Sports Phy Ther. Aurora, EUA, vol. 37, nº 5, p. 232-238, maio 2007.

SOARES AV, PAGLIOSA F, OLIVEIRA GO. Estudo comparativo entre a estimulação elétrica neuromuscular de baixa e média frequência para o incremento da força de preensão em indivíduos sadios não-treinados. Fisioterapia Brasil. Vol. 3, n. 6, p. 345-350, nov/dez, 2002.

THRASHER TA, POPOVIC MR. Functional electrical stimulation of walking: function, exercise and rehabilitation. Ann Readapt Med Phys. 5:452-60, 2008.

VAZ MA, FRASSON VB. Low-frequency pulsed current versus quilohertz-frequency alternating current: A scoping literature review. Arch Phys Med Rehabil. Apr; 99 (4): 792-805, 2018.

WARD AR, OLIVER WG, BUCCELLA D. Wrist extensor torque production and discomfort associated with low-frequency and burst - modulated kilohertz-frequency currents. Journal of the American Physical Therapy Association. 86 (10):1360-7, 2006.

WARD AR, ROBERTSON VJ, IOANNOU H. The effect of duty cycle and frequency on muscle torque production using kilohertz frequency range alternating current. Med Engineer Physics. 26: 569-579, 2004.

WARD AR, SHKURATOVA, N. Russian Electrial Stimulation: The Early Experiments. Physical Therapy. v. 82, n. 10, p. 1019-30, 2002.

WARD AR, TOUMBOUROU, LS. Lowering of Sensory, Motor, and Pain-Tolerance Thresholds With Burst Duration Using Kilohertz-Frequency Alternating Current Electric Stimulation. Arch Phys Med Rehabil. Vol 88, n. 8, p. 1036-1041, August 2007.

Abstract

Introduction: Neuromuscular electrical stimulation (NMES) has been used as one of the pillars of the therapeutic modalities for the gain of muscle strength. Objective: To evaluate the strength gain in the elbow flexor muscles in women after the use of NMES. Materials and Methods: 17 women were selected, randomically separated in 2 groups, (Russian Current and Aussie Current). Aussie current was used with the carrier current parameters of 1000Hz, frequency modulated 50Hz, burst of 2 milliseconds and for the Russian carrier current it was used 2,500 Hz, modulated frequency of 50 Hz, phase (cycle) of 50% both with up and down parameters of 2 seconds, ON and OFF time of 20 seconds, for a total time of 20 minutes in the brachial triceps muscle, with sufficient intensity to provide visible and tolerable muscular contraction, for a period of 5 weeks. The strength measurement was done by means of a portable dynamometer. Results: The paired t-test and Student's t-test were used for statistical analysis and the significance level of p = 0.05 was considered. There was an increase in muscle strength in both stimulated arms, with the mean gain in the Aussie group being 10.5 pounds and in the Russian Current group of 14.5 pounds, but there was no statistically significant difference between the electric currents. Conclusion: The two currents were effective in gaining muscle strength and there was no statistically significant difference in the comparison of them, but the groups were different as to the force at the time pre-stimulation.

Electric stimulation therapy, muscle strength, physical therapy modalities.

ÉLECTROTHÉRAPIE DE MOYENNE FRÉQUENCE DANS LA FORCE MUSCULAIRE

Résumé

Introduction: La stimulation électrique neuromusculaire (SENM) vient étant utilisée comme un des piliers des modalités thérapeutiques pour le profit de la force musculaire.

Objectif: Évaluer le profit de force musculaire des extenseurs du coude dans des femmes après SENM.

Matériels et Méthodes: 17 femmes ont participé de l'étude, divisées de manière randomizasé dans deux groupes (Courant Russe et Courant Aussie). A été utilisée la Courant Aussie avec les paramètres de chaîne porteuse de 1000Hz, fréquence modulée de 50 Hz, burst de 2 millisecondes et pour la Courant Russe, courant transporteur de 2.500 Hz, fréquence modulée de 50 Hz, phase (cycle) de 50%, les deux avec des paramètres de montée et descente de 2 secondes, temps ON et OFF de 20 secondes, pour un temps total de 20 minutes dans le ventre musculaire de tríceps brachial, avec une intensité suffisante pour fournir de la contraction musculaire visible et tolérable, pour une période de 5 semaines. La mensuration de force a été faite au moyen d'un Dynamomètre portable.

Résultats: Pour l´analyse statistique est utilisé l'essai t apparié et T Student et considéré le niveau d'importance de p=0,05. Il a y eu une augmentation de la force musculaire dans les deux les bras stimulés, étant la moyenne de profit au groupe Aussie 10.5 livres et dans le groupe Courant Russe 14.5 livres, néanmoins, il n'y a pas eu de différences statistiquement significatives entre les chaînes.

Conclusion: Les deux chaînes ont été efficaces dans le profit de la force musculaire et il n'y avait aucune différence statistiquement significative en comparaison entre les mêmes. Néanmoins, les groupes étaient différents en ce qui concerne la

force au moment pré stimulation.
Mots-Clés: Thérapie par stimulation électrique, force musculaire, modalités de physiothérapie

ELÉCTROTERAPIA DE MÉDIA FRECUENCIA EN LA FUERZA MUSCULAR

Resumen
Introducción: La estimulación eléctrica neuromuscular (EENM) viene siendo utilizada como uno de los pilares de las modalidades terapêuticas para la mejora de la fuerza muscular.
Objetivo: Evaluar la mejora de la fuerza muscular de los extensores del codo em mujeres después de la EENM.
Materiales y métodos: Participaron 17 mujeres, divididas de manera aleatória en 2 grupos (Corriente Rusa e Corriente Aussie). La corriente Aussie fue utilizada com los parámetros de la corriente portadora de 1000 Hz, frecuencia modulada de 50 Hz, burst de 2 milisegundos y para la corriente Rusa, corriente portadora de 2500 Hz, frecuencia modulada de 50Hz, fase (ciclo) de 50%, ambos con parámetros de subida y bajada de 2 segundos, tiempo ON e OFF de 20 segundos, por um tiempo total de 20 minutos en el vientre muscular del tríceps braquial, con uma intensidad suficiente para proporcionar contracción muscular visible y tolerable, por um período de 5 semanas. La medición de la fuerza fue hecha por médio de un dinamómetro portátil.
Resultados: Para el análisis estadístico fue utilizada la prueba T pareado o de pares de datos y T student y considerado el nível de valor de p= 0,05. Hubo aumento de la fuerza muscular em ambos brazos estimulados, siendo el promedio de mejora en el grupo Aussie de 10.5 libras y en el grupo corriente Rusa de 14.5 libras, sin embargo, no hubo diferencia estadisticamente significativa entre las corrientes.
Conclusión: Las dos corrientes fueron eficaces em la mejora de la fuerza muscular y no hubo diferencia estadisticamente significativa comparando las mismas. No obstante los grupos eran diferentes en relación a la fuerza en el momento de pre-estimulo.
Palabras-clave: Terapia por estimulación eléctrica, fuerza muscular, modalidades de fisioterapia.

AVALIAÇÃO DA ELETROESTIMULAÇÃO DE MÉDIA FREQUÊNCIA NA FORÇA MUSCULAR

Resumo
Introdução: A estimulação elétrica neuromuscular (EENM) vem sendo utilizada como um dos pilares das modalidades terapêuticas para o ganho de força muscular. Objetivo: Avaliar o ganho de força muscular dos extensores do cotovelo em mulheres após EENM. Materiais e Métodos. Participaram 17 mulheres, divididas de maneira randomizada em dois grupos (Corrente Russa e Corrente Aussie). Foi utilizado a corrente Aussie com os parâmetros de corrente portadora de 1000Hz, frequência modulada de 50 Hz, burst de 2 milissegundos e para a corrente Russa, corrente portadora de 2.500 Hz, frequência modulada de 50 Hz, fase (ciclo) de 50%, ambos com parâmetros de subida e descida 2 segundos, tempo ON e OFF de 20 segundos, por um tempo total de 20 minutos no ventre muscular do tríceps braquial, com uma intensidade suficiente para proporcionar contração muscular visível e tolerável, por um período de 5 semanas. A mensuração de força foi feita por meio de um Dinamômetro portátil. Resultados: Para análise estatística foi utilizado o teste t pareado e T Student e considerado o nível de significância de p=0,05. Houve aumento da força muscular em ambos os braços estimulados, sendo a média de ganho no grupo Aussie de 10,5 libras e no grupo Corrente Russa de 14,5 libras, porém, não houve diferença estatisticamente significante entre as correntes. Conclusão: As duas correntes foram eficazes no ganho de força muscular e não houve diferença estatisticamente significante na comparação entre as mesmas. Porém os grupos eram diferentes quanto à força no momento pré estimulação.
Palavras-chave: Terapia por estimulação elétrica, força muscular, modalidades de fisioterapia