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Aussie Current and Myofascial Release in Muscular Power and Muscle: Controlled and Randomized Clinical Trial

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Abstract- *Among the techniques identified as the possibility of accelerating and/or optimizing the process of muscle, strength gain is myofascial release and electrostimulation. Given this context, this study seeks to analyze and compare the effects of combined use of the Aussie current and myofascial release on muscle strengthening. This is a cross-sectional study, analytical and descriptive, experimental, comparative, controlled and randomized. The study sample is non-probabilistic composed of 16 volunteers who will be subdivided into four groups. The muscular strength gain of the quadriceps muscles will be evaluated bilaterally through the countermovement vertical jump. The interferential statistics used were through the paired Student t-test to verify the difference between the means before and after the treatments in each group, and it was also the Mannn-Whitney U test to verify the differences concerning the techniques. The significance level adopted will be 5% (α = 0.05). Regarding the parameters of the evolution of muscular strength gain related to vertical jump distance, significant statistical differences were observed only for GL and GT in the initial-intermediate evaluation (p = 0.025 and p = 0.035, respectively). Regarding the evolution parameters of mean differences of 70% of the maximum load of 1RM, significant statistical differences were observed only for GA in the initial-intermediate and intermediate-final evaluations (p = 0.035 p = 0.035, respectively). It was not possible to identify a statistically significant advantage of the combined use of the techniques in the Todos Group over their isolated use.*

Keywords*—Electrical Stimulation, Physiotherapy, Muscle Strength.*

I. INTRODUCTION

Muscle strengthening (FM) can be defined as the maximum capacity of a muscle or muscle group to exert a large force at a given speed and generate active tension, and the ability to produce strength depends on several determinants, including the muscular system, neural, biomechanical and psychological factor (BITTENCOURT, 2018; TRINITY, 2018). Several methods are used by physiotherapists for muscle strengthening, including active exercises, resistance actives, and also neuromuscular electrical stimulation (NMES) (ALVES et al., 2017).

Within this context of FM, there is a need, depending on the patient's objective and / or the worked muscles, to focus the training aiming at the gain of muscular power. Muscle power corresponds to the high intensity of contraction with the highest speed possible in the execution of the movement, generating recruitment of a large number of fibers, especially type II fibers that have

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high strength, power production and speed in anaerobic activities (STRAIGHT et al., 2015).

Frequently, FM prescription is mainly the object of desire for injury prevention, aesthetic and sports/rehabilitation programs. Among the techniques used as a possibility to accelerate the process of muscle strength gain is myofascial release (LM), which consists of a passive and manual technique that can be performed with or without an instrument. It is a deep mobilization of connective tissue that prioritizes the fascia which is a flexible and strong membrane and involves muscles, bones, viscera and blood vessels protecting and assisting in the slides between them (SILVA; ALEXANDRE; SILVA, 2018).

According to Arguisuelas et al. (2017), the technique causes excessive pressure in the rigid areas to act on the muscle spindle cells by inhibiting them and stimulating the Golgi tendon organs that will alter muscle tone leading to relaxation. Several studies show the effectiveness of the LM technique. The LM aims to increase blood supply, muscle oxygenation, consequently decrease muscle contracture, pain and optimize movement, ie, make the tissue more flexible and functional (SILVA et al., 2017).

Another possibility mentioned in the literature for increased muscle strength is neuromuscular electrostimulation (NMES), which is a technique used as a therapeutic resource and muscle training through the application of electrical currents through transcutaneous pathways. For Agripino (2017) the effects of stimulation with medium frequency currents and high intensity lead to muscle fiber hypertrophy (type II - 50% and type I - 20%), type II fibers have a greater effect because the high current amplitude would be more oriented to power than to resistance.

For Franco et al. (2017) the use of electric currents for aesthetic and sports treatment has been very active, among them the Aussie current which is a medium frequency current 4000Hz presenting minimum discomfort using 1kHz in favor of a maximum torque production for strength gain. and tropism can use the modulation in short duration Burst, ie 2 ms making it more comfortable for both sensory and motor stimulation. Despite the literature, it is lacking controlled and randomized studies that prove the increase of muscular strength / muscular power due to the combination of Aussie current and myofascial release.

Therefore, it is essential to conduct studies in this segment since accelerating the increase in FM / Muscle Power would be beneficial for sports/rehabilitation. Thus this study seeks to analyze and compare the efficacy of the combined use of the Aussie current and myofascial release in strengthening and muscle power.

II. MATERIALS AND METHODS

This is a cross-sectional study, analytical-descriptive, experimental, comparative, controlled and randomized, using quantitative data analysis. It is noteworthy that this research is a subproject of the study entitled "Physiotherapeutic performance in orthopedic and sports dysfunctions". Regarding the study site, it was developed in an Electrothermophototherapy and Kinesiotherapy Laboratory of the Physiotherapy course of a private college in the city of Vitoria da Conquista-BA, located in the southwest region of Bahia, occupying a territorial area of 3204,257 Km2, with an estimated population of 346,069 inhabitants (IBGE, 2016). The sample is non-probabilistic composed of 16 volunteers who will be subdivided into four (4) intervention groups: Control Group - CG (4); Strengthening and Aussie Group - GA (4); Myofascial Release and Strengthening Group -GL (4); Strengthening, Myofascial Release and Aussie Group - GLA (4).

The randomization of the groups was performed with the aid of MathWorks Inc's Matlab® software, using the rand function, which generates random numbers of equal probability between zero and one. Those who received numbers between 0 and 0.25 were allocated in the control group (CG), those who received numbers between 0.26 and 0.5 were allocated in GA, those who received numbers between 0.6 and 0.75 were allocated. Finally, those who received numbers between 0.76 and 1.0 were allocated to the GLA. Inclusion criteria were female individuals, aged between 18 and 40 years and not practicing physical activity with the objective of quadriceps muscle strengthening. The choice of single-sex individuals will be to prevent the study results from being influenced by the possible gender differences in muscle strengthening. For similar reasons, age will be limited to 40 years to also prevent results from being influenced by age on the ability to gain muscle strength. In addition, interference bias in treatment efficacy is avoided by including only individuals who do not perform other activities for the purpose of gaining quadriceps muscle strength.

Exclusion criteria were individuals who during the selection period for the study intervention refer to the use of food supplementation; who use anti-inflammatory drugs or pain relievers for continuous use; have altered skin sensitivity in the quadriceps region; have pacemakers; have phobia to electrostimulation; have deep vein thrombosis; being in gestational period; have recent lower limb musculoskeletal injuries (lower limbs); have neurological pathologies that lead to changes in sensory perception or motor control of the lower limbs; have severe lower limb arthroplasty that interferes with function and range of motion; as well as having lower limb amputations or severe heart disease.

The dependent variable muscle power was assessed through the countermovement vertical jump (SCM): from the standing position and without any shoes, with the right trunk and hands on the hips, and the lower limbs in extension, the individual performs a 90 ° knee flexion (countermovement), followed by a vertical jump touching the wall with the fingers of the right hand that were previously placed in contact with chalk dust (SILVA; OLIVEIRA, 2017). The highest point touched by the participant's fingers on the wall was recorded, and then the distance from this point to the ground was measured with an inelastic tape measure. Thus, participants in each group were evaluated before the first intervention, before the 7th intervention and after the 12th intervention (final intervention).

The variable dependent muscle strength was evaluated by the load offered in barbell with dumbbells supported on shoulders according to the 1 repetition maximum test which is characterized by the highest load to be exceeded in one maximum repetition. Gradually increase the weight to concentric failure. Subsequently, the calculation was made at 70% of perceived 1RM (MARTÍNEZ-CAVA et al., 2018).

For the independent variables we used the Aussie current that was applied with the protocol-based Neurodyn 10-channel Ibramed® device with the objective of muscle power gain (FRANCO et al., 2017), using the following parameters: carrier frequency: 1 kHz; modulated frequency: 110 Hz; Burst duration: 2 ms; time on: 3 s; time off: 9 s; Rise time: 2 s; Descent time: 2 s; Treatment time: 50 min. The patient's failure/fatigue limit was respected by interrupting the application of the current according to the patient's request. Will be used 3 channels/exits of the device (6 electrodes) longitudinally arranged using the technique of application on motor points in each of the quadriceps muscles (vastus medialis, vastus lateralis and quadriceps bilaterally).

It is noteworthy that before the application of the electrodes, the preservation of the patient's skin sensitivity was evaluated using the esthesiometer instrument (Semmes-Weinsten® Monofilaments).

Another independent variable is the use of myofascial release in the quadriceps muscle that was performed by manual technique for 2 minutes in each muscle, vastus lateralis, rectus femoris and vastus medialis (quadriceps) exerting moderate pressure and parallel to the direction of the muscle fibers. At the time of the technique, the volunteer was supine on the stretcher and with the bare quadriceps region and relaxed muscles to allow the application of the technique. Subsequently, the participants underwent a quadriceps muscle strengthening exercise session with the same protocol as the CG.

Regarding the procedure of collection in the first contact with patients who agreed to participate in the study and who met the inclusion and exclusion criteria, the Informed Consent Form (ICF) was presented, which is the first instrument to be used. used. After clarification and signing of the informed consent, the patients were submitted to the application of a sociodemographic and health conditions questionnaire

The sociodemographic questionnaire was built by the researcher himself and consists of questions related to the identification of participants such as name, age, gender, education, profession, marital status, physical activity practice, medication use, how long have you been in pain, among others.

After this initial evaluation, groups were randomly assigned to the volunteers. From this moment on, participants in each group were evaluated in the Vertical Jump Test with countermovement before the first intervention, before the 7th intervention and after the last intervention (12th).

Interventions in all groups occurred 3 times a week for 4 weeks. The members of the CG only performed muscle strengthening with squat exercise from 0º of knee flexion to the 90º limit of flexion and returning to degree 0. The load was offered in a barbell with dumbbells supported by shoulders according to the test. 1 The maximum repetition of each individual and the number of repetitions was according to the concentric failure of the individual's muscle. The participants in the GA group performed the squat exercise with the same protocol as the CG in conjunction with the use of the Aussie Chain as previously described in this study. It is noteworthy that in this case, the squat time in each repetition was according to the established contraction and relaxation times in the electrostimulation device. The GL volunteers have initially submitted to quadriceps muscle myofascial release (LM) session bilaterally according to the protocol already described in this study and later will be submitted to quadriceps muscle strengthening exercise session with the same protocol as the CG. The GLA volunteers, in addition to being initially submitted to the LM session for 2 minutes in each muscle of the quadriceps group, performed muscle strengthening together with the use of

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the Aussie Chain according to the protocol performed by the GA group. Data analysis was performed using descriptive statistics with a distribution of absolute frequencies, means, and standard deviation. Data normality was tested by the Kolmogorov - Smirnov test. The interferential statistics used were through the paired Student t-test to verify the difference between the means before and after the treatments in each group, and it was also the Mannn-Whitney U test to verify the differences in relation to the techniques. The adopted significance level was 5% (α = 0.05). Data were tabulated using The Statistical Package for Social for Windows program (SPSS 21.0, 2013, SPSS, Inc., Chicago, IL).

Regarding ethical aspects, this research will obey the ethical standards required by Resolution No. 466/2012 (National Health Council). The protocol of the main study was submitted to the Ethics Committee on Research with Human Beings of the Independent Faculty of the Northeast, and the collection was started only after approval and authorization by CEP-FAINOR (Opinion: 2.418.72). In the first contact with the patients, orientations and instructions about the research process were performed. Participants were informed about the theme, development, and objectives of the study, thus being free to agree to participate or not. Once I accepted the voluntary participation, I was asked to sign the consent form, making them make their decision fairly and without constraints about their participation in this study.

III. RESULTS AND DISCUSSION

The sample composed of 16 individuals had a mean age of 21.31 ± 2.70 years, a height of 162.12 ± 6.31 cm and a weight of 57.46 ± 7.93 Kg. incomplete higher education 87.5% (14), standard race 62.5% (10), single marital status 100.0% (16) and do not practice physical activities 75.0% (12) of the situations, as outlined in table 1.

Table 1 - Sociodemographic and anthropometric characteristics of the participants. Vitória da Conquista - BA, 2019.

Variables	Mean ± SD[1]	Response	n	%
		100		
Age, *yers*	21,31 ± 2,70		16	—
Height, *cm*	162,12 ± 6,31		16	—
Weight, *Kg*	57,46 ± 7,93		16	—
Schooling		100		
Médio completo			1	6,3
Superior incompleto			14	87,5
Superior completo			1	6,3
Race		100		
White			5	31,3
Black			1	6,2
Brown			10	62,5
Civil Status		100		
Single			16	100,0
Maried			—	—
Divorced			—	—
Widowed			—	—
Physical Activity		100		
Yes			4	25,0
No			12	75,0

[1] Sample standard deviation; cm (centimeters); Kg (kilograms); Source: Research Data.

Regarding the analysis of dependent variables, the sample presented a higher percentage gain in vertical jump distance for the intermediate assessment (6th session) for the Release group (2.89%), followed by the Everyone group (2.28%). From the intermediate evaluation to the final evaluation, the highest percentage gain was maintained for LG (1.30%) and reversed for the TG, with the smallest (-0.13%), as shown in table 2.

Table 2 - Evaluation of average differences in vertical jump distance. Vitória da Conquista – BA, 2019.

Groups	Initial - Intermediate		Intermediate – Final	
	Dif[1]. Avg	% gain	Dif[1]. Avg	% gain
Control	1,00	0,43	2,30	0,98
Aussie	1,00	0,43	1,70	0,74
Release	6,50	2,89	3,00	1,30
All	5,30	2,28	-0,30	-0,13

[1] Average difference; Source: Research Data.

Regarding the parameters of the evolution of muscular strength gain related to vertical jump distance, significant statistical differences were observed only for GL and GT in the initial-intermediate evaluation (p = 0.025 and p = 0.035, respectively), as shown in table 3.

Table 3 - Evaluation of average differences or vertical jump distance. Vitória da Conquista – BA, 2019.

Groups	AVG ± SD			p^{*1}	p^{*2}
	INITIAL	INTERMADIATE	FINAL		
Control	234,7 ± 9,70	235,7 ± 9,11	238,0 ± 10,55	0,252	0,078
Aussie	230,0 ± 13,83	231,0 ± 6,53	232,7 ± 7,04	0,810	0,069
Release	225,0 ± 8,44	231,5 ± 8,89	234,5 ± 11,81	0,025	0,190

All	232,2 ± 9,5	237,5 ± 6,85	237,2 ± 7,13	0,035	0,836

Paired student t-test; Inicial Initial comparison - intermediate; ²Intermediate - final comparison; Source: Research Data.

The evolution analyzed for the percentage gain of the average differences of 70% of the maximum load of 1 RM revealed, in the intermediate evaluation (6th session) higher values for GL (30.77%) and GT (21.28%). However, it was observed in the final evaluation that GL and GT had lower percentage gains (5.0% and 3.51%, respectively), as shown in table 4

Table 4 - Evaluation of average differences in vertical jump distance. Vitória da Conquista – BA, 2019.

Groups	Initial - Intermediate		Intermediate – Final	
	Dif¹. Avg	% gain	Dif¹. Avg	% gain
Control	1,20	4,29	6,30	21,58
Aussie	3,50	12,96	6,00	19,67
Release	8,00	30,77	1,70	5,00
All	5,00	21,28	1,00	3,51

¹Average difference; Source: Research Data.

Regarding the evolution parameters of mean differences of 70% of the maximum load of 1RM, significant statistical differences were observed only for GA in the initial-intermediate and intermediate-final evaluations (p = 0.035 and p = 0.035, respectively) as shown in table 4.

Table 5 - Evaluation of average differences of 70% of maximum load of 1RM. Vitória da Conquista – BA, 2019.

Groups	AVG ± SD				
	INITIAL	INTERMADIATE	FINAL	p*¹	p*²
Control	28,0 ± 3,26	29,2 ± 9,42	35,5 ± 12,87	0,757	0,244
Aussie	27,0 ± 9,30	30,5 ± 8,85	36,5 ± 11,0	0,035	0,035
Release	26,0 ± 6,32	34,0 ± 11,54	35,7 ± 5,91	0,232	0,759
All	23,5 ± 6,61	28,5 ± 4,43	29,5 ± 9,0	0,096	0,718

* Paired student t-test; Inicial Initial comparison - intermediate; ²Intermediate - final comparison; Source: Research Data.

Based on the information collected in the results section, it was possible to observe that the vertical jump evaluation showed a significant increase in GL and GT, and this increase was only in the first 6 sessions. After the 6th session, the increment was not significant. According to Arguisuelas et al. (2017), the myofascial release technique treats soft tissue adhesions, reduces sensitivity, relieves pain and improves the performance of many modalities, being of great importance in sports. Several studies show the effectiveness of the myofascial release technique in gaining lower limb muscle power. Among these, we can mention Silva and Oliveira (2017), who states that during myofascial release, excessive pressure in the rigid areas acts on muscle spindle cells, inhibiting them, and stimulating Golgi tendon organs that will alter the tone. muscle generating relaxation, leading to muscle relaxation and fascia distension, which facilitates the sliding of muscles during movement.

Thus, for Silva and Oliveira (2017), if the fascia becomes more detached, consequently, it facilitates rapid muscle contraction generating an explosion. As the vertical jump is evaluating the fast contraction speed of the muscle fiber, it can be associated that the fast contraction capacity was facilitated by a “looser” fascia, being valid to emphasize that the study by Silva and Oliveira (2017) used self -liberation, differentiating one from the ML technique used in the present study. Studies such as Lima (2018) also show the effectiveness of the LM in the flexibility of the lower limbs that can be characterized as the ability of the muscle to distance itself from the origin and insertion promoting the greater articular range. Thus, as it decreases fascial restriction and adhesion, it consequently improves the performance of a set of movements or a specific movement by improving power performance.

Despite the positive result of muscle power with the LM, it is known that some techniques the window of gain is until a certain session, ie reach if the peak and later there will be no gain. Thus, the results of the present study suggest that only 6 LM sessions are required to obtain satisfactory results for muscle power. There are no further gains. The WG, as well as the WG, had gained to the muscular power, however, when observing that the isolated WG did not obtain gains, it is suggested that the gain obtained in the WG is due to the use of the LM, also observing that the % of the gain this group in these first 6 sessions was also slightly smaller than GL.

Concerning the strength gain evaluated by 1RM, it was possible to observe significant gain only in GA, with an increase of 9.5kg. Concerning GA, Franco et al. (2017) the Aussie current should be used to increase and accelerate muscle strength gain because through a mechanism that simulates the passage of the nerve impulse that propagates to the neuromuscular junction, releases acetylcholine and generates a muscle contraction.

Montenegro et al. (2019) have advantages in Aussie sensory and motor thresholds compared to other electrostimulation currents, stating that it can also reach muscle recruitment levels using lower current intensity,

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highlighting that one of the main limiting factors for increased force Muscle is discomfort. Dantas et al. (2014) note that the Aussie current generates faster hypertrophy because it recruits more fibers generating stress and increased mitochondria that result in higher volume, consequently hypertrophy.

In this context, an increase in torque capacity will occur. The results of the above studies support and support the results of the present study in which there was an increase in muscle strength throughout the use of Aussie in patients. Regarding the GT, it was noticed that there was no increase in strength gain. Oliveira and Pereira (2018), describe that the LM technique mainly reaches the superficial layer of the tissue receiving little or no stimulus to the muscle fibers. As the LM was used in the GT, the release may harm the strength gain, as the GL did not present load-bearing capacity gain, since the GL did not show significant force increase either.

IV. CONCLUSION

From the results of the present study, it could be observed that there is no advantage in associating the Aussie current and myofascial release for the gain of muscle strength and power. It was also possible to register that Aussie is more effective for hypertrophy, obtaining gains throughout the treatment course, and that myofascial release generates benefits for muscle power. Thus, the isolated use in the clinical practice of Aussie for FM gain and LM for power gain is suggested, generating benefits for a faster recovery of the athlete or non-athlete individual in rehabilitation, as well as a greater increment of positive results. facing the goal desired by healthy high-performance athletes.

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