Aussie current in students with chronic neck pain: a randomized controlled trial

Corrente Aussie em estudantes com cervicalgia crônica: um ensaio clínico randomizado

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ABSTRACT

BACKGROUND AND OBJECTIVES: Neck pain is a painful acute or chronic syndrome that affects the region of the cervical spine. Electrostimulation is one type of treatment, which provides local analgesia bringing more comfort and functionality to the patient. However, there are still there are other current forms not fully explored. Therefore, the objective of the study was to evaluate the analgesic and functional effects of the Aussie current on students with chronic neck pain.
METHODS: Twenty-four individuals were separated in a control group (n=11) and an electrostimulation group (n=13) with current intensity at the sensory level. There were 3 interventions per week for 4 weeks, totaling 12 interventions per individual. The assessment was performed applying the Neck Disability Index, the visual analog scale of pain, the handgrip dynamometer, and the cervical spine goniometry before the intervention, shortly after the treatment period, and after a month of follow-up.
RESULTS: In relation to all the assessed items, there was no significant difference between the three evaluations in the control group and in the treated group.
CONCLUSION: The Aussie current at the sensory level did not provide significant analgesic and functional effects in students with chronic neck pain.
Keywords: Electric stimulation therapy, Neck pain, Pain measurement.

RESUMO

JUSTIFICATIVA E OBJETIVOS: A cervicalgia é uma síndrome dolorosa, aguda ou crônica, que acomete a coluna cervical. Uma das formas de tratamento é a eletroestimulação, que proporciona analgesia local trazendo mais conforto e funcionalidade ao paciente. Contudo ainda existem formas de corrente pouco exploradas. O objetivo do estudo foi avaliar os efeitos analgésicos e funcionais da corrente Aussie em estudantes com cervicalgia crônica.
MÉTODOS: Vinte e quatro indivíduos foram separados em grupo controle (n=11) e grupo de eletroestimulação (n=13), com intensidade da corrente em nível sensorial. Foram realizadas 3 intervenções por semana, durante 4 semanas, totalizando 12 terapias por indivíduo. A avaliação foi feita com a aplicação do questionário *Neck Disability Index*, da escala analógica visual, do dinamômetro de preensão manual, e da goniometria da coluna cervical antes da intervenção, logo após o período de tratamento, e depois de um mês de seguimento.
RESULTADOS: Em relação a todos os quesitos avaliados, não se verificou diferença significativa entre as três avaliações no grupo controle e no grupo tratado.
CONCLUSÃO: A corrente Aussie, atingindo apenas o nível sensorial, não proporcionou efeitos analgésicos e funcionais significativos em estudantes com cervicalgia crônica.
Descritores: Cervicalgia, Mensuração da dor, Terapia por estimulação elétrica.

INTRODUCTION

Neck pain is a common complaint of pain in adults, and it is much related to the use of computers and the work overload; factors influencing the exacerbation of symptoms[1]. It affects the overall well-being of the individual and the health of the society in general, defined as a public health problem and of great importance in the world society[2]. It can arise from various causes, such as radiculopathy, cervicogenic headache, tumors, spondylitis, and arthritis. It is common in several age groups, with a higher incidence in females, undermining their daily activities[1]. In general, it can be related to abrupt movements, long stay in forced position, repetitive movements, effort or trauma, resulting in painful, inflammatory picture, loss of range of motion (ROM), neck flexor and extensor muscles fatigue, local stiffness and reduction of proprioception[2]. Moreover, it takes a large number of people to pharmacological addiction, emotional instability, depression, work-related disorders and disability in daily activities[3].

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Electrical stimulation has shown to be effective to inhibit pain by promoting analgesia through the ascending and descending pathways[4]. The most common currents used in clinical practice are the transcutaneous electrical nerve stimulation (TENS), both at low and high frequency, the interferential current (bi or tetrapolar), and the neuromuscular electrical stimulation (FES). The two first ones are usually chosen when the objective is to reduce the painful picture[5]. However, when evaluating currents of average frequency, with different carrier currents, Ward and Robertson[6] observed that 1kHz had higher torques than the higher frequencies. Even within this current range, burst modulation with lower frequencies than those observed in the Interferential and Russian have better torque production characteristics and sensitivity[7,8].

Ward, Oliver and Bucella[9] compared two forms of medium frequency currents (Russian and Aussie currents) with two forms of monopolar low frequency, evaluating both the torque produced as the discomfort. They noted that the Russian current produced a torque lower than the others, and those of medium frequency was more pleasant. Thus, they concluded that the Aussie (1kHz and short burst duration) is a good choice when you want comfort associated with high levels of torque. Despite the favorable reports about its use, there is a gap concerning the use of the Aussie current for analgesia below the motor threshold.

The objective of this study was to evaluate the effects of the Aussie current on students with chronic neck pain, as well as its accommodation characteristics.

METHODS

Quantitative, experimental and randomized trial (samples collected by convenience). For this study, we recruited 26 students from the State University of Western Paraná (UNIOESTE) of both genders (20 women and 6 men), with an average age of 21.81±2.48 years, height 1.67±0.08m, weight 66.31±14,95kg, and body mass index (BMI) 23.12±4.27kg/m^2, who had chronic neck pain. The participants were equally divided into the control group (CG-placebo treatment) and Aussie Group (AG). The sample calculation, based on the prehension strength, with standard deviation and difference to be detected of 2.8I/cm^2, 80% power, presented 12 individuals to each group.

To participate in the study, the participants should be 18 to 30 years of age, students of UNIOESTE, have neck pain for more than three months, with pain when moving the neck, have never received any kind of electrical stimulation on the site, willingness to be present during the treatment or evaluation periods, and sign the Free and Informed Consent Form (FICT).

The exclusion criteria were cervical-related surgery, pregnancy, heart pacemaker, ingestion of painkillers 30 days before the procedure and during the experiment period, radiculopathy, local sensitivity changes. Two volunteers of the CG were excluded due to absence.

The data collection and the interventions were performed at the Physical Rehabilitation Centre (PRC) of UNIOESTE. The Neck Disability Index (NDI)[10], adapted to Portuguese, was applied to collect the individual's data about pain intensity, personal care, lifting objects, reading, headaches, attention, work, driving cars, sleep and leisure. In addition to this questionnaire, the visual analog scale (VAS) was also used, with a 10cm increments scale ruler, with indications of pain-free (zero level) and maximum pain (level 10). On the contralateral side (the evaluator's view side) there was a centimeter ruler. The assessment was performed before the intervention (Av1) after intervention (Av2) and reapplied within a month of follow-up (Av3).

In addition to the evaluations, the active goniometry of the cervical spine was performed in the same moments, in the flexion, extension, and lateral flexion movements, with a universal goniometer with evaluation in degrees; the prehension strength test using a manual dynamometer (North Coast Medical®), measuring in pounds per cm^2.

The intervention with the Aussie current (Neurodyn - Ibramed®) was performed three times a week for four weeks, totaling 12 applications in each individual. The base frequency was of 1000Hz (1kHz), modulated at 50Hz, with a four-millisecond cycle duration. The intensity used was considered strong, but not painful, not reaching the motor threshold. Two silicone-rubber electrodes were used (2x4cm). One on the atlanto-occipital region and the other on the spinous process of the second thoracic vertebrae (Figure 1).

Given the accommodation phenomenon to the electric current, the intensity and time it took to occur the first accommodation were assessed in the 1st, 4th, 8th and 12th procedures.

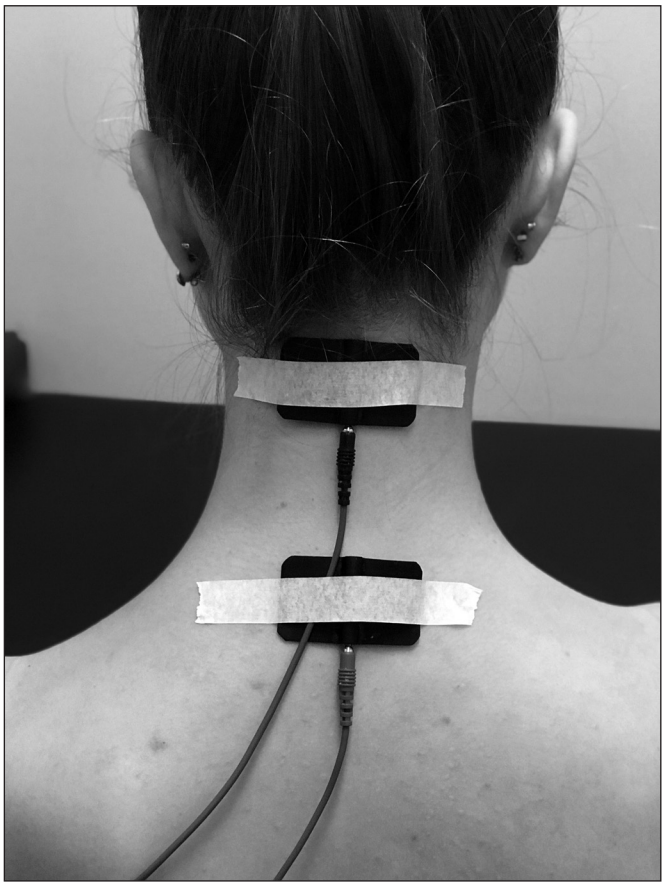

Figure 1. The position of the electrodes during the application of the Aussie current, used in both groups

This study was approved by the Research Ethics Committee of UNIOESTE, with report number 2.162.923

Statistical analysis

The data are presented in median, 1st and 3rd quartiles for NDI and VAS, with comparison within the groups with the Kruskal-Wallis test and comparison among the groups with Mann-Whitney. For the prehension strength and goniometry, the data are presented in average and standard deviation, with comparisons made by unidirectional ANOVA and t-test for unpaired samples, intragroup and intergroup, respectively. For current accommodation variables, the data are presented in average and standard deviation, with comparisons made by unidirectional ANOVA. In all cases, the accepted level of significance was 5%.

RESULTS

There was no significant difference among the three evaluations in the intragroup and intergroup comparison for the NDI and VAS (Table 1).

Again, no significant differences were observed in the prehension strength and movements evaluated (Table 2).

Regarding accommodation, related to the time required to occur the first event, there were no significant differences among the evaluated therapies, but there was to the intensity. The first presented lower values than the others (Table 3).

Table 1. Results of the Neck Disability Index and the visual analog scale, comparing the assessments conducted in each group and intergroup

			CG	AG	p-value
NDI	Av1	Median 1st - 3rd Q	20 14-26	24 20-28	0.1644
	Av2	Median 1st - 3rd Q	14 12-15	16 14-24	0.2024
	Av3	Median 1st - 3rd Q	12 9-20	20 10-26	0.3391
	p-value		0.3933	0.0964	
VAS	Av1	Median 1st - 3rd Q	4 3-4.5	3 3-5	0.8393
	Av2	Median 1st - 3rd Q	2 2-4	2 2-3	0.7943
	Av3	Median 1st - 3rd Q	2 1.5-3	3 2-5	0.1396
	p value	p value	0.0525	0.3052	

CG = control group; AG = Aussie current; VAS = visual analog scale; NDI = Neck Disability Index; Av1 = pre-intervention; Av2 = post-intervention; Av3 = after one month of follow-up.

Table 2. Results of the prehension test and goniometry, with average and standard deviation, comparing the evaluations intragroup and intergroup

		CG	AG	p-value
Prehension	Av1	9.9±3.1	9.8±2.5	0.9128
	Av2	9.7±2.9	10.3±2.6	0.6500
	Av3	9.1±2.6	9.3±2.3	0.7694
	p value	0.7055	0.6966	

Continue...

Table 2. Results of the prehension test and goniometry, with average and standard deviation, comparing the evaluations intragroup and intergroup – continuation

		CG	AG	p-value
Flexion	Av1	42.6±7.2	40.1±7.1	0.409
	Av2	44.2±6.5	44.7±7.2	0.8382
	Av3	43.8±8.1	43.8±6.3	0.9925
	p value	0.8749	0.2118	
Extension	Av1	45.4±7.9	39.3±7.6	0.0705
	Av2	45.1±6.4	44.1±7.9	0.7348
	Av3	43.9±8.2	42.6±8.8	0.7165
	p value	0.8781	0.3291	
Right lateral flexion	Av1	36.9±7.5	37.7±13.2	0.8508
	Av2	36.8±4.6	39.6±7.6	0.3006
	Av3	36.0±6.3	38.5±9.8	0.4451
	p value	0.933	0.8991	
Left lateral flexion	Av1	36.9±8.9	32.3±8.6	0.2213
	Av2	34±7.1	35.6±5.1	0.5197
	Av3	35.1±6.4	38.4±5.1	0.1655
	p value	0.6701	0.0668	

CG = control group; AG = Aussie current; Av1 = pre-intervention; Av2 = post-intervention; Av3 = after one month of follow-up.

Table 3. Results of the interventions in the treated group, observing the accommodation threshold (time in seconds) and intensity (milliamps)

Procedures	Time	Intensity
1st	267.6±172.5	20.6±10.1
4th	233.4±176.2	38.1±17.8*
8th	253.8±216.5	39.6±19.1*
12th	300±136.3	37.7±11.1*

*Significant difference when comparing with the first procedure.

DISCUSSION

The increased use medium frequency currents in rehab follows the theory that they are more comfortable and more effective than of low-frequency currents since the first has a lower impedance on the skin, being able to stimulate deeper tissues, although reports point out varied antinociceptive effects between currents[11-13]. There is a need for new research with electrostimulation in the treatment of spinal pain[14].

In the present study, the 1kHz Aussie current was used in students with chronic non-specific neck pain, and the intensity was assessed by the VAS and the functional disability by the NDI. Both are validated and well-established in the literature[10,13,15]. Despite the reports that the electrical stimulation positively affects the treatment of individuals with neck pain, such as TENS[12,16,17] and the Interferential[11], in this study, the variables related to pain and disability did not present differences in relation to the baseline values or intergroup. Corrêa et al.[18] observed in individuals with chronic low back pain that the interferential current, of 1 and 4kHz (AMF of 100Hz, for 30 minutes, 3 days a week for 4 weeks), produced significant reduction in pain intensity. Over

time, there was a reduction in the use of painkillers and an increase in the pressure pain threshold. Unlike the present study, the procedure time was longer, but Oliveira et al.[19] assessing the analgesic effects of TENS showed similar results between 20 and 40 minutes.

Also using the 1kHz interferential current, but in healthy individuals, Venancio et al.[20] observed that 20 minutes of stimulation increased the pressure pain threshold. However, it is a more uncomfortable frequency than the 4, 8 and 10kHz. Agripino[21] evaluating healthy individuals, noted the effectiveness of the medium frequency of alternating current, Aussie, during 20 minutes, with 1 and 4kHz (2ms burst duration, modulated at 50Hz), on the perceived intensity of pain, but not for the pressure pain threshold, where the 4kHz showed to be superior. In the study by Pereira et al.[22] they assessed the effects of the interferential current, of 2kHz, on the threshold of induced pain, applied for 15 minutes, with the electrodes arranged in the nerve roots of C3 to T1, transcutaneously, by the bipolar technique. There was no change in the pressure pain threshold, but it decreased the pain threshold to cold. Thus, it is assumed that an increase of the base frequency used could bring more benefits regarding the pain threshold, keeping the intensity below the contraction threshold and the application in similar nerve roots.

Regarding the goniometry, the present study did not evidence an amplitude increase in any of the tested cervical movements, despite all of them be restricted. Dissanayaka et al.[12] observed improvements in the neck ROM in individuals who received the low-frequency current, these results were not found in those who received the medium frequency (interferential).

Moberg et al.[23], evaluating healthcare professionals, noticed an association between VO_{2max}, prehension strength and musculoskeletal pain. Thus, in this study, we observed if the Aussie current could improve the prehension strength by changes in the chronic neck pain. However, as already described, there were no changes in pain or in the manual prehension strength. A similar result was observed by Myśliwiec et al.[24] that compared the Saunders traction with TENS in individuals with neck pain. They observed an improvement in the prehension strength only for the first treatment option. Regarding the acute effects of spinal manipulation, both in healthy subjects[25] and with chronic neck pain[26], no differences were found in the manual prehension strength.

With regard to the accommodation characteristic of the electric current, which is common to other forms of electrostimulation[27], in this study we aimed at evaluating the behavior throughout the treatments, but only for the intensity, it was possible to observe differences between the first therapy and the others. This may have occurred due to the sense of novelty in the use of current because, in the following days, the volunteers better put up with higher initial intensity. It is worth mentioning that one of the limitations was not to evaluate the behavior of other accommodations within the same therapy.

CONCLUSION

The Aussie current, applied without producing muscle contraction, did not provide significant analgesic and functional effects in students with chronic neck pain, and they tolerated higher intensities during the therapy until the accommodation.

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