Original Article

Is there a difference in the positioning of TENS electrodes in the treatment of primary dysmenorrhea? Randomized study

Existe diferença no posicionamento dos eletrodos da TENS no tratamento da dismenorreia primária? Estudo randomizado

Amanda da Rocha Rodrigues[1]
Fernanda de Oliveira Almeida[2]
Priscila de Oliveira Januário[3]
Ariela Torres Cruz[4]

[1]Corresponding author. Centro Universitário de Barra Mansa (Barra Mansa). Rio de Janeiro, Brazil. rochaamanda.r@gmail.com
[2-4]Centro Universitário de Barra Mansa (Barra Mansa). Rio de Janeiro, Brazil. nanda03.11@hotmail.com, pri.januario@gmail.com, ariela_tcruz@yahoo.com.br

ABSTRACT | INTRODUCTION: Dysmenorrhea is the most frequent painful condition in adolescents and young women that causes absenteeism and presenteeism at work and school. It is characterized by a mild, moderate, or severe pain in the anterior pelvic region of the colic type, which can happen before, during, or after menstrual flow. **OBJECTIVE:** To compare the influence of Transcutaneous Electrical Nerve Stimulation (TENS) in pelvic pain caused by primary dysmenorrhea with the electrodes applied in the anterior and posterior pelvic region. **METHODS:** 50 university students were randomly assigned to two groups of 25 volunteers: Anterior Pelvic Region Group (GA) and Posterior Pelvic Region Group (GP), who were submitted to TENS for 30 minutes and the intensity increased every 10 minutes and evaluated by the Visual Analog Pain Scale before, after and two hours after the end of treatment. GA participants had the electrodes applied in the anterior pelvic region and GB in the posterior pelvic region. **RESULTS:** There was a decrease in the pain in the moments before and after treatment (GA and GP p<0.0001) and before and two hours after treatment (GA and GP p <0.0001). In the moments after the treatment and two hours after its end, it was possible to observe an increase in the pain in GA (p=1.0000) and a decrease in the GP, however, the values were not statistically significant (p=0.8443). **CONCLUSION:** The use of TENS contributed to the reduction of pain in women in both groups, without statistical difference between them. Brazilian Registry of Clinical Trials: RBR-67cjv5.

KEYWORDS: Dysmenorrhea. Transcutaneous Electrical Nerve Stimulation. Physical Therapy Specialty.

RESUMO | INTRODUÇÃO: Dismenorreia é a condição dolorosa mais frequente em adolescentes e mulheres jovens causando absenteísmo e presenteísmo no trabalho e na escola. É caracterizada por um quadro álgico leve, moderado ou severo na região pélvica anterior do tipo cólica, o qual pode acontecer antes, durante ou depois do fluxo menstrual. **OBJETIVO:** Comparar a influência da Estimulação Elétrica Nervosa Transcutânea (TENS) na dor pélvica causada pela dismenorreia primária com os eletrodos aplicados na região pélvica anterior e posterior. **MÉTODOS:** 50 universitárias foram aleatoriamente distribuídas em dois grupos de 25 voluntárias: Grupo Região Pélvica Anterior (GA) e Grupo Região Pélvica Posterior (GP), que foram submetidas a TENS durante 30 minutos tendo a intensidade aumentada a cada 10 minutos e avaliadas pela Escala Visual Analógica de Dor antes, depois e duas horas após o término do tratamento. As participantes do GA tiveram os eletrodos aplicados na região pélvica anterior e as do GB na região pélvica posterior. **RESULTADOS:** Houve uma diminuição do quadro álgico nos momentos antes e após o tratamento (GA e GP p<0,0001) e antes e duas horas após o tratamento (GA e GP p<0,0001). Nos momentos depois do tratamento e duas horas após o seu término foi possível observar aumento do quadro álgico no GA (p=1,0000) e diminuição no GP, porém os valores não foram estatisticamente significativos (p=0,8443). **CONCLUSÃO:** O uso da TENS contribuiu para a redução do quadro álgico das mulheres de ambos os grupos, sem diferença estatística entre estes. Registro Brasileiro de Ensaios Clínicos: RBR-67cjv5.

PALAVRAS-CHAVE: Dismenorreia. Estimulação Elétrica Nervosa Transcutânea. Fisioterapia.

Submitted 11/17/2020, Accepted 01/14/2021, Published 01/25/2021
J. Physiother. Res., Salvador, 2021 February;11(1):163-172
http://dx.doi.org/10.17267/2238-2704rpf.v11i1.3411 | ISSN: 2238-2704
Designated editors: Adriana Saraiva, Katia Sá

How to cite this article: Rodrigues AR, Almeida FO, Januário PO, Cruz AT. Is there a difference in the positioning of TENS electrodes in the treatment of primary dysmenorrhea? Randomized study. J Physiother Res. 2021;11(1):163-172. http://dx.doi.org/10.17267/2238-2704rpf.v11i1.3411

Introduction

Dysmenorrhea is a painful condition that affects 50% to 90% of women of reproductive age, being more frequent in adolescents and young women. It is the most common symptom in gynecological consultations, characterized by a severe pain condition, commonly of the colic type, being classified according to its intensity and may be mild, moderate, or severe, which precedes or accompanies the menstrual flow[1].

From its clinical aspect, there are two types of dysmenorrhea: the primary one called functional or spasmodic associated with normal ovulatory menstrual periods, and the secondary one, also known as organic, that can appear years after the start of menstruation and is related to uterine diseases[2].

The onset of primary dysmenorrhea usually occurs 6 to 24 months after menarche, when ovulatory cycles are determined[1]. That occurs in patients with no organic lesions, without a well-defined etiology. Among the causes, psychogenic, myometrial, endocrine, and the influence of prostaglandins and leukotrienes are evident. It is believed that the greater release of prostaglandins in the menstrual flow causes uterine contraction and pain[3].

The symptoms of primary dysmenorrhea are a pain in the anterior pelvic region (lower abdomen) and posterior pelvic region (lumbar region), which can radiate to the lower limbs. It may also be accompanied by nausea, headache, irritability, diarrhea or constipation, vomiting, dizziness, and breast tenderness. Severity can be associated with anticipated menarche, duration of menstrual flow, obesity, history of sexual abuse, smoking, alcoholism, and emotional disorders[2].

Dysmenorrhea is often under-diagnosed and undertreated. The main treatments include drugs such as non-steroidal anti-inflammatory, analgesic, and oral contraceptive pills. These present side effects such as ulceration, gastrointestinal intolerance, inhibition of platelet aggregation, uterine motility, renal function through prostaglandin, and changes of sensitivity. Although little studied, alternative therapies are often used because they provide better control of symptoms and have few side effects. The data are still limited and contradictory on the effectiveness of changes in the diet, use of supplements, and herbs[1,4].

Other non-pharmacological treatments include psychotherapy and physiotherapy, which is extremely relevant and efficient in women who cannot undergo conventional pharmacological treatment[5].

Physiotherapy has therapeutic resources to reduce discomfort and contribute to the prevention of primary dysmenorrhea with techniques such as global stretching, myofascial release, massage therapy, perineal contraction, short waves, manipulation of vertebrae, pulsed ultrasound, and transcutaneous electrical nerve stimulation (TENS)[6].

TENS is a non-invasive resource that has been widely recommended for the treatment of primary dysmenorrhea to relieve pelvic pain. It is a method of stimulation of peripheral nerves through electrodes attached to the skin, which acts on pain modulating systems, increasing pain tolerance and causing analgesia. Its effect is based on the theory of floodgates and the activation of the endogenous opioid system[7].

Studies show the use of TENS as a therapeutic resource in the treatment of primary dysmenorrhea, however, research does not standardize the location of the electrodes, as well as the other parameters used[8-11]. The application of electrodes in the anterior pelvic region stimulates the sensory nerves of T12, the root of the uterine sensory fibers. The application of electrodes in the posterior pelvic region presents proximity to the upper hypogastric plexus, which transmits the visceral painful impulses of the uterus[7]. These findings are related to the greater innervation of the uterus occurring in the segments of the thoracolumbar transition and sacral segments, associating these data with the elasticity of the connective tissue, which would be increased due to the hormonal variation that occurs in menstrual cycles[12]. Therefore, it is essential to develop studies that address low-cost physiotherapy resources and without side effects that can alleviate pelvic pain due to primary dysmenorrhea. Based on the subject, this study aimed to compare the influence of TENS on pelvic pain caused by primary dysmenorrhea with the electrodes applied in the anterior and posterior pelvic region, with the hypothesis that the application of the electrodes in the posterior pelvic region is more effective than application of the electrodes in the anterior pelvic region.

Methods

This is a randomized clinical study that started after the approval of the Research Ethics Committee of the Centro Universitário de Barra Mansa (UBM) under opinion number 2.764.865 (CAAE 91396518.0.0000.5236), respecting all the ethical principles that guide the research, as well as the privacy of its contents, as recommended by international documents and Resolution 466/12 of the National Health Council of the Ministry of Health, is registered in the Brazilian Registry of Clinical Trials: RBR-67cjv5.

The sample selection was carried out for convenience, using non-probabilistic sampling. 50 university students participated, aged between 18 and 30 years, who accepted to participate voluntarily in the study after disclosure and invitation made in classrooms of a University Center in the interior of the state of Rio de Janeiro, according to the Free and Informed Consent Term (FICT). Recruitment was carried out in July 2018 and treatment was carried out between July and September 2018. Volunteers aged 18 to 30 years, with pelvic pain caused by primary dysmenorrhea, between the first and the third day of the menstrual cycle and who had grades between 1 and 10 on the Visual Analog Pain Scale (VAS) were included in the study. Those who were using analgesics and other therapies for pelvic pain, who had gynecological diseases and undiagnosed abdominal pain were excluded. Volunteers with cardiac pacemakers, cardiac complications, and those with grade 0 in VAS were also excluded. Randomization was carried out by a lot, using an opaque envelope that contained two other sealed envelopes, describing the proposed treatments. The participants knew what treatment they would undergo when they arrived to perform the treatment. The trained evaluator was the same one who selected, carried out the draw, evaluated, and treated them. The participants were distributed in two equal groups of 25 volunteers: Group anterior pelvic region (GA) and Group posterior pelvic region (GP).

The objectives and conduct of the study were presented to the participants. Firstly, they answered a questionnaire prepared by the authors to outline their sociodemographic and health profile and to verify those that fit the inclusion and exclusion criteria. This questionnaire was applied by a single researcher before the procedure. As soon as the first symptoms appeared, the volunteers contacted the researchers so that the appointment could be scheduled as soon as possible. The participants were evaluated employing VAS before the application of TENS, after its application, and 2 hours after its completion. This is a scale from 0 to 10, where 0 means total absence of pain and 10 means the maximum pain level that the patient can support. Mild pain from 1 to 3, mean from 4 to 7, and maximum from 8 to 10 were considered.

All participants were submitted to a consultation using the 2-channel Neurodyn III TENS device (IBRAMED® - Brazil, 2018). Four carbon-impregnated rubber electrodes measuring 5x5 cm were used, which were properly attached to the skin by conductive gel and fixed with masking tape, located in the pelvic region in the crossfire. Asepsis was performed at the site of the application of the electrodes with 70% alcohol and cotton. The following parameters were used: frequency of 10 Hertz (Hz), pulse duration 300 μs, for 30 minutes, and the intensity was increased every 10 minutes. The initial intensity was the maximum that the participant considered comfortable. The participants of the GA remained in the supine position, and the electrodes applied to the anterior pelvic region (1 electrode 2 cm medially from the upper right anterior iliac spine, 1 electrode 2 cm medially from the left upper anterior iliac spine, and 2 electrodes, each of which 2 cm below the electrodes applied superiorly), and the participants of the GP remained in the prone position, with a pillow under the abdomen to avoid a lumbar hyperlordosis, and the electrodes were applied in the posterior pelvic region (2 electrodes 2 cm above the iliac spines superior postero, one to the right and one to the left, and 2 electrodes 2 cm below the superior postero iliac spines, one to the right and one to the left).

The collected data followed a normal distribution, therefore, the sociodemographic and health profile of the study groups verified through the questionnaire carried out in the first contact with the participants were expressed by the absolute and relative frequency, mean and standard deviation, considering the confidence interval (CI) of 95%. When comparing variables between groups, t-Student or Mann-Whitney tests were preferred for two categories and ANOVA or Kruskal-Wallis with Dunn's post hoc for over two categories, with a 5% significance level. Regarding the analysis of treatment times, ANOVA One-way and Kruskal-Wallis tests were performed with Tuckey post hoc and the significance level of 5%. For statistical tests, the BioEstat version 5.0 program was used.

Results

165 volunteers were interviewed. Of these, 108 were excluded for only responding to initial contact, 4 for having untreated polycystic ovary, and 3 for having undiagnosed abdominal pain (Flowchart 1). The profile of the participants is shown in Table 1. After analyzing the times before and after treatment in GA, it was possible to observe a statistically significant reduction in the pain of the study participants (p=0,0001). Between the times after the treatment and two hours after the end of it, there was an increase in pain (p=0,7700), however, checking the values before the treatment, and two hours after its end, it was observed that there was a statistically significant decrease in pain (p<0,0001). In the GP, comparing the times before and after treatment, there was a statistically significant reduction in pain (p<0,0001), as well as in the times before and two hours after its end (p<0,0001). Between the time after the treatment and two hours after the end of the treatment, there was a reduction in pain but was not statistically significant (p=0,5259). When comparing the GA and GP in the times before (p = 0.6578), after the treatment (p = 0.8080), and two hours after its end (p = 0.4141), it was observed that there was no statistical difference significant (Graph 1).

Flowchart 1. Study design and participants follow up through the trial

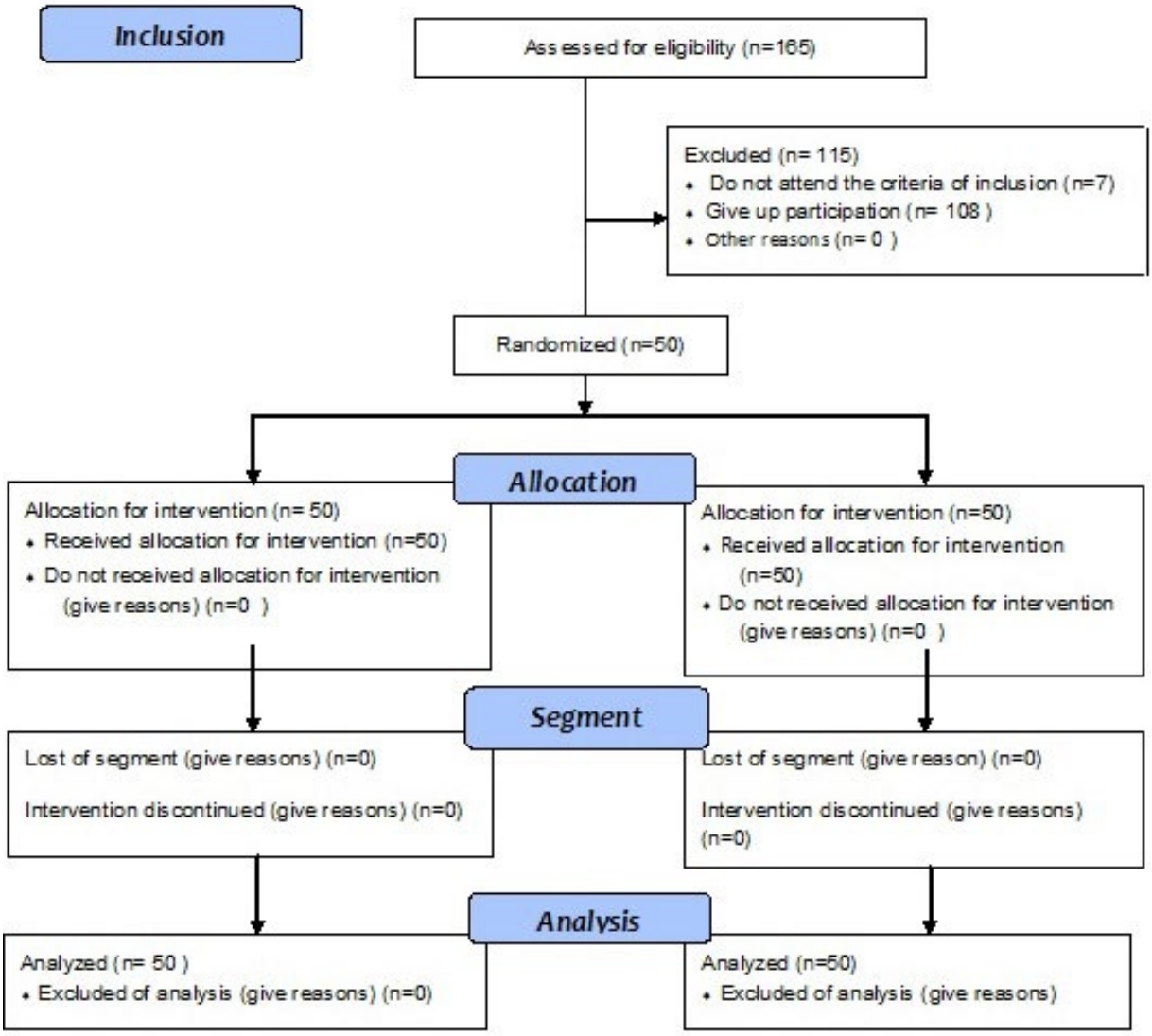


Table1. Profile of the study groups (to be continued)

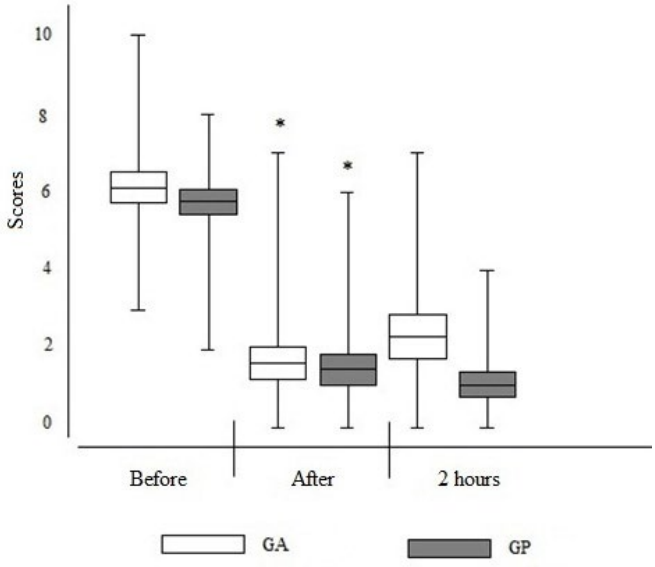
	GA			GB			
Variables	**n (%)**	**Average/SD**	**CI**	**n (%)**	**Average/SD**	**CI**	**P-value comparison**
Age							
18 to 20 years	9(36)	5 ±2,73	2,90-7,09	14 (56)	7,5 ±4,18	5,08-9,91	ns[3]
21 to 25 years	13(52)	7 ±3,89	4,64 - 9,35	9 (36)	5 ±2,73	2,90-7,09	ns[3]
26 to 30 years	3(12)	6,5±3,60	2,44-15,44	2 (8)	1,5 ±0,70	4,78-7,78	0,317[2]
What age ocurred at menarche?							
< 10 years	6(24)	3,5±1,87	1,53-5,46	2(8)	1,5 ±0,70	4,78-7,78	0,027[1*]
11 a 15 years	19(76)	10±5,62	7,29-12,70	23(92)	12±6,78	9,06-14,93	0,156[1]
Menstrual Cycle							
Regular	14(56)	7,5±4,18	5,08-9,91	18(72)	9,5±5,33	6,84-12,15	0,127[2]
Irregular	11(44)	6±3,31	3,77-8,22	7(28)	4±2,16	2,00-5,99	0,074[2]
Moderate Flow	**20(80)**	**10,5±5,91**	**7,73-13,26**	**17(68)**	**9±5,04**	**6,40-11,59**	**0,208[2]**
Severe	5(20)	3±1,58	1,03-4,96	8(32)	4,5±2,44	2,45-6,54	0,103[2]
In which region is the pain located?							
Lumbosacral	2(8)	1,5±0,70	4,78-7,78	4(16)	2,5±1,29	0,44-4,55	0,130[2]
Pelvis	12(48)	6,5±3,60	4,21-8,78	9(36)	5±2,73	2,90-7,09	0,148[2]
Lower limbs	1(4)	1±1	1-1	0(0)	0±0	0-0	0,438[2]
All alternatives	8(32)	4,5±2,44	2,45-6,54	3(12)	2±1	2,44-15,44	< 0,05[3*]
Lumbosacral + Pelvis	1(4)'	1±1	1-1	7(28)	4±2,16	2,00-5,99	< 0,05[3*]
Lumbosacral + Lower limbs	1(4)	1±1	1-1	2(8)	1,5±0,70	4,78-7,78	0,317[2]
What kind of pain?							
Colic	11(44)	6±3,31	3,77-8,22	5(20)	3±1,58	1,03 -4,96	< 0,05[3*]
Throbbing	4(16)	2,5±1,29	0,44-4,55	6(24)	3,5±1,87	1,53-5,46	0,139[2]
Twinge	5(20)	3±1,58	1,03 -4,96	7(28)	4±2,16	2,00-5,99	0,142[2]
All alternatives	2(8)	1,5±0,70	4,78-7,78	0(0)	0±0	0-0	0,102[2]
Throbbing + Twinge	2(8)	1,5±0,70	4,78-7,78	1(4)	1±1	1-1	0,317[2]
Colic+ Throbbing	1(4)	1±1	1-1	2(8)	1,5±0,70	4,78-7,78	0,317[2]
Colic + Twinge	0(0)	0±0	0-0	4(16)	2,5±1,29	0,44-4,55	< 0,05[3*]

Tabela 1. Perfil dos grupos de estudo (conclusion)

On which day of the cycle is the pain most intense?							
1° day	6(24)	3,5±1,87	1,53-5,46	14(56)	7,5±4,18	5,08-9,91	< 0,05[3*]
2° day	2(8)	1,5±0,70	4,78-7,78	1(4)	1±1	1-1	0,317[2]
3° day	4(16)	2,5±1,29	0,44-4,55	0(0)	0±0	0-0	< 0,05[3*]
All alternatives	5(20)	3±1,58	1,03 -4,96	4(16)	2,5±1,29	0,44-4,55	0,317[2]
1° and 2° days	7(28)	4±2,16	2,00-5,99	4(16)	2,5±1,29	0,44-4,55	0,061[2]
2° and 3° days	1(4)	1±1	1-1	2(8)	1,5±0,70	4,78-7,78	0,317[2]
Does the pain occur outside the menstrual period?							
Yes	12(48)	6,5±3,60	4,21-8,78	5(20)	3±1,58	1,03 -4,96	0,007[1*]
No	13(52)	7 ±3,89	4,64 - 9,35	20(80)	10,5±5,91	7,73-13,26	0,029[1*]
How long does this pain persist?							
8 hours	6(24)	3,5±1,87	1,53-5,46	11(44)	6±3,31	3,77-8,22	< 0,05[3*]
12 hours	2(8)	1,5±0,70	4,78-7,78	3(12)	6,5±3,60	2,44 - 15,44	0,317[2]
24 hours	14(56)	7,5±4,18	5,08-9,91	5(20)	3±1,58	1,03 -4,96	< 0,05[3*]
72 hours	3(12)	6,5±3,60	2,44 - 15,44	6(24)	3,5±1,87	1,53-5,46	0,058[2*]
Most cited symtoms							
Irritability	17(28)	9±5,04	6,4011,59	14(22)	7,5±4,18	5,08 - 9,91	0,074[2]
Headache	17(28)	9±5,04	6,4011,59	14(22)	7,5±4,18	5,08 - 9,91	0,074[2]
Bloated sensation	16(26)	8,5±4,76	5,96-11,03	20(32)	10,5±5,91	7,73-13,26	< 0,05[3*]
Diarrhea	6(10)	3,5±1,87	1,53 - 5,46	6(10)	3,5±1,87	1,53 - 5,46	
Sweating	5(8)	3±1,58	1,03 - 4,96	9(14)	5±2,73	2,90-7,09	< 0,05[3*]
Do you use painkillers to relieve the symptons of dysmenorrhea?							
Yes	6(24)	3,5±1,87	1,53 - 5,46	4(16)	2,5±1,29	0,44-4,55	0,168[1]
No	19(76)	10±5,62	7,29 -12,70	21(84)	11±6,20	8,17-13,82	0,298[1]
Do you use contraception?Utiliza contraceptivo?							
Yes	10(40)	5,5±3,02	3,33-7,66	12(48)	6,5±3,60	4,21-8,78	0,244[1]
No	15(60)	8±4,47	5,52-10,47	13(53)	7±3,89	4,64 -9,35	0,266[1]
Are you aware of physical therapy in the treatment of dysmenorrhea?							
Yes	10(40)	5,5±3,02	3,33-7,66	4(16)	2,5±1,29	0,44-4,55	0,011[1*]
No	15(60)	8±4,47	5,52-10,47	21(84)	11±6,20	8,17-13,82	0,056[1*]

Legend: Sociodemographic and health aspects expressed in absolute and relative frequency- n (%), average and standard deviation - SD; GA- anterior pelvic region group; GP- posterior pelvic region group; ns- not significant; [1]t-Student ou Mann- Whitney test; [2]ANOVA or Kruskal-Wallis with [3]Dunn post hoc; *5% significance level; CI-Confidence Interval 95%.

Graph 1. Comparison between moments of GA and GP



Discussion

The non-blinding of the evaluation and randomization is considered as one of the limitations of this study, as well as the sample size. As non-probabilistic sampling was used, the sample calculation was not performed. The reduced number allows the results to be considered only for the population in question. However, it is an exploratory study with important practical implications, and these findings may contribute to the decision making of physiotherapists during the treatment process.

According to Silva et al.[2] innumerable studies demonstrate the predominance of primary dysmenorrhea in the young adult population, between 16 and 43 years old, a data confirmed by Silva et al. (2019) 13 who interviewed 107 volunteers between 18 and 45 years old with a mean age of 31,5 ±7,6 years. In the current survey, all volunteers were between 18 and 30 years old with an average age of 21,66 ±2,5 years. The literature also shows that the highest incidence of dysmenorrhea is in women with menarche around 12 of age[14]. In the present study, it was observed that 84% of the participants stated that their menarche occurred between 11 and 15 years old.

A history of an irregular menstrual cycle is described as a risk factor for dysmenorrhea. A woman who has an irregular menstrual cycle on a monthly basis will be almost twice as likely to develop dysmenorrhea compared to those who have a regular cycle[15]. In the present study, most participants in both groups had a regular menstrual cycle (GA 56% and GP 72%) and menstrual pain (GA and GP 100%), thus disagreeing with these data. The relationship between irregularity and menstrual pain is associated with the secretion of prostaglandins[15].

Pain occurs mainly in the midline and is often described as a cramp in the lower abdomen or suprapubic region, which can radiate around the abdomen, in the lumbar region, and along the thigh[1], as found in the present study. Besides, secondary symptoms such as nausea, vomiting, fatigue, low back pain, headache, dizziness, and diarrhea may occur[16], corroborating the data of this research.

A study evaluated 19 women who mentioned pain under the venter (100%) and lumbar region (52.6%)[15], which is in agreement with the present study since in GA 48% reported pain in the pelvic region and 8% in the region lumbosacral and in the GP 36% reported it in the pelvic region and 16% in the lumbosacral region. The most accepted explanation for these findings is due to the greater innervation of the uterus occurring in the segments of the thoracolumbar transition (T10-L1) and sacral segments (S2-S4)[17]. Petrofsky and Lee[12] correlated these variables with the elasticity of connective tissue, which would be altered due to the hormonal variation that occurs in menstrual cycles, and found a decrease in postural control in the ovulation phase.

The main approaches for the treatment of primary dysmenorrhea syndrome include pharmacological and non-pharmacological methods, such as psychotherapy and physiotherapy[5], which offers therapeutic resources aimed at reducing pain practically and economically and may even improve quality of life, through the use of some modalities such as kinesiotherapy, manual therapy, and electrotherapy[18].

TENS can be classified into four modalities: conventional, acupuncture, burst, and brief-intense. There are indications that TENS is effective both at high and low frequency in relieving the symptoms of dysmenorrhea[19]. A systematic review analyzed 6 studies with the application of high-frequency TENS in primary dysmenorrhea and observed the effectiveness of this resource in relieving pain, despite the wide application variation[8], however, in the present study, high pulse duration and low frequency were used.

TENS has proven to be a successful non-invasive method for pain control. Its mechanisms of action involve the release of endorphins in acupuncture mode, constituting a possible solution for women who suffer from dysmenorrhea and do not experience relief with other forms of treatment[20]. In the present study, it was observed a reduction in the pain of participants with this mode of application. This technique can provide analgesia due to a change in the body's ability to perceive the painful stimulus, and this strengthens the thesis that pain in primary dysmenorrhea is due to uterine activity. In this case, pelvic pain decreases, but uterine contractions remain present. This therapeutic resource is based on the supply of electrical current on the skin through surface electrodes. Its effect occurs due to the stimulation of sensitive nerve fibers that influence and modulate the neuroconduction process of pain, acting on the release of endogenous opioids at the medullary and pituitary level[21].

A randomized clinical study[2] found that conventional TENS (frequency 150hz and pulse duration 50 μs) was more effective than placebo TENS for reducing pain in patients with primary dysmenorrhea. Despite the use of different parameters, the present study also demonstrated a reduction in the participants' pain after treatment with TENS.

In a study by Machado et al.[22] it was observed that TENS with a frequency of 100 Hz and intensity of 200μs for 30 minutes with the electrodes positioned in the anterior pelvic region provided rapid relief of the pain. In the present study, both the application of the electrodes in the anterior and posterior pelvic regions provided relief for the participants' pain. Despite the similar result, the parameters used were different.

Baldan, Freitas and Zambello[7] reported that the electrodes in the posterior pelvic region obtained satisfactory results because it is a place near the superior hypogastric plexus location (L5-S1 height), which transmits visceral pain impulses from the uterus, however, satisfactory results are found in the literature with the electrodes also in the anterior pelvic region, stimulating the sensory nerves of the T12 dermatome, which is the nerve root of the uterine sensory fibers, as observed in the present study.

For Lee et al.[9] there is limited evidence on the duration of TENS-induced analgesia in the treatment of primary dysmenorrhea. The results of randomized studies demonstrate that the pain profile decreases continuously 8 and 24 hours since the beginning of the application of TENS[18]. In this research, the follow-up time of just 2 hours is considered as one of the limitations, however, there was a decrease in the pain after the application of the technique, as well as 2 hours after the end in the GP, however, these values were not statistically significant.

The way in which TENS is applied can cause a conflict between cumulative effects and tolerance. It has been suggested that for chronic pain, this cumulative effect without analgesic tolerance is achieved only if the intensity is not fixed and there is a continuous increase, but without causing a sensation of pain. This increase is performed as the participant gets used to the intensity of the current over time and allows it to increase to higher levels of tolerance[23], just like in this study where the intensity was increased every 10 minutes, in order to avoid that the participants get used to the stimulus applied.

It is believed that due to a non-standardization in the methodologies, the differences observed in the results of studies that address this theme may be related to the positioning of the electrodes and the parameters used, such as frequency, pulse duration and application, making comparisons between results difficult. No studies were found in the literature that compared the location of the application of the electrodes in pelvic pain caused by primary dysmenorrhea, however, Elboim-Gabyzon and Kalichman[23] affirm that the electrodes should be applied over the area of pain in each menstrual cycle. Therefore, there may not be a standard for the application of electrodes in dysmenorrhea. This study has clinical applicability and can clarify to physiotherapists about the use of TENS in patients with primary dysmenorrhea.

Conclusion

After analyzing the data, it was possible to conclude that TENS was effective in reducing the pain in the research participants both in GA and in the GP, with no statistical difference between the groups. It is suggested that other studies be carried out with a larger number of participants, longer treatment and follow-up times, and the comparison of other parameters in order to standardize the use of TENS to relieve the symptoms caused by primary dysmenorrhea.

Author contributions

Rodrigues AR and FO Almeida participated in the collection and processing of data, literature review and writing. Januário PO participated in the analysis and interpretation of data and critical review of the text. Cruz AT participated in the design and development, planning, literature review, analysis and interpretation, writing and critical review.

Competing interests

No financial, legal or political conflicts involving third parties (government, companies and private foundations, etc.) have been declared for any aspect of the submitted work (including, but not limited to, grants and funding, participation in advisory council, study design, preparation of the manuscript, statistical analysis, etc.).

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