The Egyptian Journal of Hospital Medicine (January 2025) Vol. 98, Page 480- 485

Effect of TENS on Acupoints in Premenstrual Syndrome

Aml Mohammed El-Sayed Abd_Elaal*, Azza Barmoud Nashed Kassab, Hossam El-Din Hussein Kamel

Department of Physical Therapy for Woman's Health, Faculty of Physical Therapy, Cairo University

Corresponding author: Aml Mohammed El-Sayed Abd_Elaal**, Email:** amlmohammed994@gmail.com, **Mobile:** 01019934798

ABSTRACT

Background: An estimated 40 percent of reproductive-age women have some symptoms of premenstrual syndrome (PMS), a collection of disorders associated to menstruation. Physical as well as psychological PMS symptoms are alleviated using transcutaneous electrical nerve stimulation (TENS).

Objectives: This study aimed to examine the effect of TENS on acupoints in premenstrual syndrome.

Subjects and methods: fifty virgin adolescent females suffering from premenstrual syndrome aged from 18 to 25 years old with BMI between 25 and 30 kg\m^2 were recruited from the gynecology and obstetrics outpatient department at Talkha Central Hospital in Dakahlia, Egypt. They were randomized into two equivalent groups. Group A (n=25) received TENS at neurogenic acupoints three days prior to menstruation until the 4th day of menstruation for three consecutive menstrual cycles seven times per month with a duration of forty minutes each session for three months. Control group (B) (n= 25) was given TENS on sham acupoints daily, 7 sessions per month with duration of 40 min for each session, for 3 months as in group (A). Pain intensity and severity of premenstrual symptoms were assessed at the beginning and at the end of the treatment for all participants in both groups (A & B) using Visual analogue scale and Menstrual Distress Questionnaire.

Results: There was a statistical significant decrease in the mean values of VAS and severity of PMS symptoms post-treatment in both groups (A & B). Moreover, a statistical significant decline was observed between both groups post-treatment in favor of group (A) (p=0.001).

Conclusion: It is possible to conclude that receiving transcutaneous electrical stimulation on acupoints had significant effect in alleviating pain and severity of PMS symptoms in adolescent females.

Keywords: Premenstrual syndrome, Acupoint, Transcutaneous electrical nerve stimulation (TEAS), Pain, Premenstrual symptoms.

INTRODUCTION

The woman's quality of life (QOL) significantly decreased during the luteal stage of her menstrual cycle due to serious physical as well as mental symptoms of premenstrual syndrome (PMS) [(1)].

A broad range of symptoms impacting physiology, behavior, emotions, and cognition characterize premenstrual syndrome. Back and muscular pain, then abdominal heaviness and discomfort, are the most common symptoms [(2)].

Researchers believe that neurological sensitivity to the normal changes in sex hormone concentrations, which occurs during the menstrual cycle is the specific cause of premenstrual syndrome, but the exact explanation is yet unclear. Physiological and psychological symptoms of premenstrual syndrome may arise as a result of these hormonal changes, which are believed to impact neurotransmitter or neuropeptide function in the brain [(3)].

Pharmacological interventions for premenstrual syndrome include hormonal therapy and symptomatic treatment with oryzanol, progesterone, and oral antianxiety medications [(4)].

Many different diseases and conditions have a lengthy history of treatment using acupuncture (AP) and the meridians. Acupuncture needles, whether handled by hand or stimulated with low current and frequency, provide the physiological foundation for modifying activity in peripheral and central nervous pathways [(5)].

There are various physiological mechanisms that can alter pain perception that include release of endogenous opioids, serotonin, and norepinephrine, which in turn affect nociceptors and inflammatory cytokines [(6)].

Conventional Chinese acupuncture and contemporary electrical methods are used in transcutaneous electrical acupoint stimulation (TEAS). Instead of needles, self-adhesive electrodes are used to stimulate conventional acupuncture sites without breaking the skin. Because of its repeatability, minimal infection risk, and precise stimulation settings, TEAS is therefore often used [(7)].

This study aimed to control PMS in adolescent females and to enhance their quality of life by investigating the effects of TENS on acupoints, as there have been very few investigations into this topic.

SUBJECTS AND METHODS

The current study was done at Talkha Central Hospital. Fifty virgin adolescent females who were diagnosed with premenstrual syndrome were recruited from The Outpatient Clinic of Gynecology and Obstetrics through the period from June 2022 to December 2022.

Received: 21/08/2024
Accepted: 21/10/2024

Inclusion criteria: Females with a BMI ranging from 25 to 30 kg\m^2 and ages that varied from 18 to 25 years. All of them suffered from moderate to severe PMS.

Exclusion criteria: Females with a history of gynecological procedures, a medical condition that would prevent them from using electrotherapy, a history of using sedatives, menstrual cycle fluctuations, or any abnormal findings in the pelvic cavity.

They were divided into two equal groups (A & B) by random assignment. **Group (A)** (study group): Twenty-five individuals underwent three successive menstrual cycles of daily TEAS upon neurogenic acupoints beginning three days prior to menstruation and ending on the 4th day of menstruation. The study group met seven times a month for three months, with each session lasting 40 minutes. **Group (B)** (control group): 25 participants received sham acupoint stimulation daily, situated only an inch from the acupoints selected by the study's participants. The control group also underwent the same protocol as group (A), with seven sessions per month for three months and 40 minutes of treatment time each session.

Methods: The severity of menstruation pain was assessed using the visual analogue scale (VAS) for each participant in groups A and B both prior to and following treatment. Individuals' pain was measured on a linear scale that extends 10 cm. A score of 0 indicates "no pain" and a score of 10 indicates "a very severe" degree of pain [(8)]. Before and after treatment, every individual in both groups (A & B) were given the Menstrual Distress Questionnaire (MDQ) to assess symptoms such as reduced activity, low back pain, stress or anxiety, breast pain, as well as headache [(9)]. On a scale ranging from 0 (no symptoms) to 4 (extremely severe disabling symptoms), we instructed every individual in both groups to assess the severity of her symptoms during her most recent menstrual cycle. We read the overall score as follows: Less than 50 - mild, moderate, and severe, defined as 50 to 70 and more than 70 respectively.

A. Evaluative Instrumentations:

1. **Recording data sheet:** Each participant's personal, previous, and menstrual history in both groups (A & B).
2. **Standard weight –height scale:** Height and weight of each participant in group A and B were measured at baseline and following treatment for BMI calculation before the beginning of the study.
3. **Visual analogue scale (VAS):** It was utilized to quantify the severity of menstruation pain for all participants in group A and B at baseline and following treatment. The approach involved using a linear scale of 10 cm to indicate the participants' discomfort. A score of zero means (No pain) and 10 means (a very severe degree of pain) [(8)].
4. **Menstrual distress questionnaire (MDQ):** It was used to assess the level of decreased activity, lumbar discomfort, anxiety, breast soreness, and headache experienced by all individuals in group A and B at baseline and following treatment [(9)]. All women in both groups were requested to describe any symptoms they had during their most recent period, using this rating scale in which symptoms were ranged from (zero) no symptoms, (1) mild, (2) moderate, (3) sever and (4) very severe disabling symptoms. Overall scores were interpreted as the following: < 50 mild, 50-70 moderate and > 70 sever.

B. Treatment instrumentations:

Transcutaneous electrical nerve stimulation (TENS): A pulse generator that runs on batteries. The eight pads on this gadget regulate the device's output. The gadget is entirely digital and controlled by microprocessor circuitry. Each participant of group (A) had TENS applied to specific acupoints.

Information about the device:

- Model: 21366093, EV-906 Digital TENS.
- A total of five modes are available for TENS units: B (Burst), N (Normal), M (Modulation), SD1 (Strength duration), and SD2.
- With a 1 Hz increment, you may set the pulse rate from 2 to 150 Hz.
- Variable pulse width (50–300 ms, 10 ms/step).
- Intensity: From 1 to 100 Ma, you may press buttons to adjust the 100-step intensity level.
- Two locations could be treated at once with the use of two different timers: One that runs for 1-60 minutes and another that runs continuously.
- Wave form: Asymmetrical Bi-Phasic square pulls [(10)].

Methods of treatment

- Throughout the course of three months, each participant in group (A) received transcutaneous electrical stimulation on neurogenic acupoints (Sp6 and LR3) once a day, for an average of seven sessions each month. About 40 minutes elapsed with each session.
- All participants received a short explanation of the treatment's purpose before the first session began in an effort to gain their confidence and cooperation.
- Each participant in this group had their chosen acupoint's skin surface cleansed with an alcohol

wipe. Each participant's chosen acupoints (SP6 and LR3) were located according to the cun, a traditional Chinese unit of length defined as one fingerbreadth across the interphalangeal joint [10].

- In group (A), each participant had the TENS electrodes stuck to their chosen acupoints on both sides of her body, and was requested to lie in supine position. TENS was adjusted with expansion mood, temporal frequency of 4 HZ, pulse width of 200 ms and fine-tuned intensity to the point where it was no longer painful. Duration of the session was 40 minutes [11]. The timer for the TENS device was set to switch off automatically once every session of treatment ended. Then, adhesive electrodes were withdrawn from participant's skin surface.
- Each participant in group (B) received transcutaneous electrical stimulation on sham points (located one inch far from the research group's chosen acupoint) 7 sessions a month for about 40 minutes each session for 3 months.
- Identical to group (A), each participant in group (B) had sham acupoints treated with a TENS device.

Ethical considerations: No: P.T. REC/012/ 003688 was the approval number given to the study by The Research Ethical Committee of the Faculty of Physical Therapy, Cairo University in April 2022. All subjects signed a permission forms. The World Medical Association's Code of Ethics (Declaration of Helsinki) for research including human subjects was followed during this study.

Statistical analysis

To compare the subject characteristics among the groups, an independent t-test was used. The data was examined for normal distribution utilizing the Shapiro-Wilk test. The homogeneity of variances among groups was tested using Levene's test. Treatment effects on VAS and MDQ were investigated using mixed MANOVA. For the following multiple comparison, post hoc tests were performed with the Bonferroni correction. A significance criterion of $p \leq 0.05$ was established for all statistical tests. For this study, we used SPSS version 25 for Windows (IBM SPSS, Chicago, IL, USA) to carry out all of our statistical analysis.

RESULTS

- Subject characteristics: Table (1) showed the physical characteristics for the two groups (A & B) as mean values. The groups did not differ significantly with respect to age, weight, height, or body mass index ($p > 0.05$).

Table (1): Mean values of demographic characteristics of both groups (A&B)

	Group A	Group B	MD	t- value	p-value	Sig
	$\overline{X}$ ± SD	$\overline{X}$ ± SD				
Age (years)	20.92 ± 2.31	22.12 ± 4.36	-1.2	-1.21	0.23	**NS**
Weight (kg)	73.12 ± 5.52	71.68 ± 6.13	1.44	0.87	0.38	**NS**
Height (cm)	163.16 ± 7	162.2 ± 5.2	0.96	0.55	0.58	**NS**
BMI (kg/m²)	27.78 ± 1.54	27.21 ± 1.56	0.57	1.28	0.2	**NS**

SD, Standard deviation; MD, Mean difference; p value, Probability value.

Effect of treatment on pain intensity and severity of premenstrual symptoms: A statistically significant interaction effect between treatment and time was found using mixed MANOVA ($F = 94.82$, $p = 0.001$). $F = 5.39$, $p= 0.007$, which indicated a statistically significant main impact of treatment. Time was the main impact ($F = 277.93$, $p < 0.001$).

Within group comparison: Compared to baseline values, pain intensity significantly decreased after treatment in both groups ($p > 0.01$). Group A showed a 24.71% drop in pain severity, but group B showed only 4.84% decrease. Treatment significantly reduced the intensity of PMS symptoms in comparison with baseline values in both groups ($p > 0.01$). Group A experienced a 32.55% reduction in pain intensity, but group B only experienced a 9.02% decline.

Between group comparison: No statistically significant difference was shown between the groups at baseline ($p > 0.05$). The pain intensity as well as severity of PMS in group A were significantly reduced compared to group B after treatment ($p < 0.001$) (Table 2).

Table (2): Mean values of pain intensity and severity of premenstrual symptoms pre and post treatment in both groups A and B

	Pre treatment	Post treatment	MD	% of change	p value
	Mean ±SD	Mean ±SD			
VAS					
Group A	6.96 ± 1.64	5.24 ± 1.26	1.72	24.71	0.001
Group B	7.44 ± 1.52	7.08 ± 1.49	0.36	4.84	0.01
MD	-0.48	-1.84			
	p = 0.29	***p = 0.001***			
MDQ					
Group A	121.28±25.93	81.8 ± 16.55	39.48	32.55	0.001
Group B	121.92±27.22	110.92 ± 25.45	11	9.02	0.001
MD	-0.64	-29.12			
	p = 0.93	***p = 0.001***			

SD, Standard deviation; MD, Mean difference; p value, Probability value.

DISCUSSION

This study was done to assess the efficacy of transcutaneous electrical acupoint stimulation in PMS. Fifty virgin adolescent females suffered from PMS took-part in this study. They were randomly assigned into two groups equivalent in number. In group (A), 25 women received TENS upon neurogenic acupoints every day from 3 days before their period to the 4th day of their period for three successive menstrual cycles. The study group met seven times a month for three months, with each session lasting 40 minutes. Group (B) (control group), 25 participants received sham acupoint stimulation daily, located one inch away from the study group's acupoint selection. The control group also underwent the same protocol as group (A), with seven sessions per month for three months and 40 minutes of treatment time each session.

The results showed that post treatment, the mean value of pain intensity decreased significantly in both the A and B groups. Furthermore, following treatment, there was a statistically significant reduction in group (A) when compared to group (B) (p= 0.001). According to the gate control theory, the mechanism of TENS in reducing pain might explain the improvement in pain intensity. Upon the administration of an electrical current, the large-diameter, rapidly conducting, highly myelinated proprioceptive sensory nerve fibers are activated, inhibiting the passage of pain signals from the site where it was applied to the brain. Also, it was postulated that endogenous opioid production may activate the descending inhibitory circuit [(12)]. This study's findings corroborate those of **Guy *et al.*** [(13)] who used transcutaneous electrical nerve stimulation to alleviate premenstrual syndrome symptoms in teenage girls. Also, it is consistent with the result of **Ibrahim *et al.*** [(14)] who found that TENS was efficient in reducing moderate to severe menstrual pain and improving daily living activities in adolescents. Along these lines, **Manisha and Anuradha** [(15)] found that adolescent girls who underwent high-frequency transcutaneous electrical nerve stimulation had less period pain three days prior to or during their periods, lending credence to our findings. But according to **Nnoaham *et al.*** [(16)] the question of whether transcutaneous electrical nerve stimulation is useful as analgesics persists despite its widespread usage. However, the present study's findings are in conflict with those of **Kalra *et al.*** [(17)] who had previously shown that TENS was ineffective compared to other methods for alleviating PMS-related lower back discomfort.

Regarding the results related to the severity of premenstrual symptoms, the current study found that group A and B experienced a statistically significant decline in their mean values of severity of PMS symptoms post-treatment. Interestingly, there was a statistically significant difference among group A and B after treatment, where group (A) showed a significant decrease (p-value = 0.001).

The possible explanations for the marked alleviation of premenstrual symptoms include: Estrogen and progestin significantly influence opioid and central serotonergic neurons by regulating neuronal activity and receptor density. AP activated the locus coeruleus

noradrenergic system as well as the serotonergic descending pathway within the dorsolateral funiculus. Inhibiting serotoninergic and opioidergic neurotransmission, which regulates a number of psychosomatic processes, is likely responsible for APs beneficial impact on PMS symptom treatment [18]. Our findings are in line with those of **Feng [19]** who looked at the impact of electro acupuncture on PMS in women aged 18–35 and discovered that in comparison with a control group that didn't get treatment, those who got treatment showed a marked improvement in the severity of their PMS symptoms. Moreover, the findings of this study came in agreement with that of **Ibrahim *et al.* [14]** who found that patients treated with TENS had significantly lower incidence and severity of nausea, vertigo, and headache. This study's findings corroborate those of **Parsa and Bashirian [20]** who discovered that active TENS effectively reduced the intensity of premenstrual syndrome symptoms without causing any negative side effects. Also, **Ojoawo *et al.* [21]** found that after 3 days of treating premenstrual syndrome with TENS, the study group's depressive symptoms were significantly less severe than the control group which corroborate our results. Contrary to our findings, a study by **Hsieh *et al.* [22]** indicated that 133 individuals with premenstrual syndrome symptoms did not improve after a single transcutaneous electrical nerve stimulation intervention.

LIMITATION AND RECOMMENDATION

This study was limited by emotional and psychological state of the participants, degree of cooperation of the participants, and personal and individual differences between participants. So Further research is required to learn how various TENS parameters work on acupoints to treat PMS. Also, another method for treating PMS is by stimulating certain acupoints with transcutaneous electrical current. Additional research is necessary to evaluate the efficacy of TENS when compared to other physical therapy techniques for the management of PMS.

CONCLUSION

It could be concluded that receiving transcutaneous electrical stimulation on acupoints had significant effect in alleviating pain and severity of PMS symptoms in adolescent females.

Sources of funding: No particular grant for this study was awarded by funding agencies in the public, private, or nonprofit organizations.

Conflicts of interest: The authors indicated that there was no conflicts of interest.

REFERENCES

1. **O'Brien Bäckström T, Brown C, Dennerstein L *et al.* (2011):** Towards a consensus on diagnostic criteria, measurement and trial design of the premenstrual disorders: the ISPMD Montreal consensus. Archives of women's mental health, 14 (1): 13-21.
2. **Bhuvaneswari K, Rabindran P, Bharadwaj B (2019):** Prevalence of premenstrual syndrome and its impact on quality of life among selected college students in Puducherry. National Medical Journal of India, 32 (1): 17–19.
3. **Daley A (2009):** Exercise and premenstrual symptomatology: comprehensive review. J Women's Health (Larchmt), 18 (6): 895-899.
4. **Green J, O'Brien S, Panay N *et al.* (2017):** On behalf of the Royal College of Obstetricians and Gynecologists. Management of Premenstrual Syndrome. International Journal of Obstetrics & Gynecology, BJOG., 124: 73-10.
5. **Chen C, Chen Y, Hsieh L *et al.* (2018):** TRPV1 is a responding channel for acupuncture manipulation in mice peripheral and central nerve system. Cell Physiol Biochem., 49: 1813-24.
6. **Zhang R, Lao L, Ren K *et al.* (2014):** Mechanisms of acupuncture–electroacupuncture on persistent pain. Anesthesiology, 120 (2): 482-503.
7. **Zhang R, Feng X, Guan Q *et al.* (2011):** Increase of success rate for women undergoing embryo transfer by transcutaneous electrical acupoint stimulation: a prospective randomized placebocontrolled study.Fertility and sterility, 96 (4): 912-916.
8. **Heller Z, Manuguerra M, Chow R (2016):** How to analyze the Visual Analogue Scale: Myths, truths and clinical relevance. Scandinavian journal of pain, 13 (1): 67-75.
9. **Dennerstein L, Lehert P, Heinemann K (2012):** Epidemiology of premenstrual symptoms and disorders.Menopause international, 18 (2): 48-51.
10. **Hassanein H, Abdel-Wahab A, Ali E *et al.* (2021):** Trans-ferulic acid ameliorates cisplatin-induced testicular damage via suppression of TLR4, P38-MAPK, and ERK1/2 signaling pathways. Environmental Science and Pollution Research, 28: 41948-41964.
11. **Kamali F, Mirkhani H, Nematollahi A *et al.* (2017):** The effect of transcutaneous electrical nerve stimulation of sympathetic ganglions and acupuncture points on distal blood flow. Journal of acupuncture and meridian studies, 10 (2): 120-124.
12. **Sluka A, Walsh D (2003):** Transcutaneous electrical nerve stimulation: basic science mechanisms and clinical effectiveness. The Journal of pain, 4 (3): 109-121.
13. **Guy M, Foucher C, Juhel C *et al.* (2022):** Transcutaneous electrical neurostimulation relieves primary dysmenorrhea: a randomized, double-blind clinical study versus placebo. Prog Urol., 32: 487-97.
14. **Ibrahim S, Rizk A, Gohar E (2021):** Effect of Transcutaneous Electrical Nerve Stimulation on Menstrual Symptoms Among Adolescent Girls. Alexandria Scientific Nursing Journal, 23 (1): 75-93.
15. **Manisha U, Anuradha L (2021):** Effect of high frequency transcutaneous electrical nerve stimulation at root level

menstrual pain in primary dysmenorrhea. J Bodyw Mov Ther, 26, 108-12.

16. **Nnoaham E, Kumbang J (2014):** Transcutaneous electrical nerve stimulation (TENS) for chronic pain. Cochrane Database of Systematic Reviews, 4. https://www.cochranelibrary.com/cdsr/doi/10.1002/14651858.CD003222/abstract
17. **Kalra A, Urban O, Sluka A (2001):** Blockade of opioid receptors in rostral ventral medulla prevents antihyperalgesia produced by transcutaneous electrical nerve stimulation (TENS). Journal of Pharmacology and Experimental Therapeutics, 298 (1): 257-263.
18. **Kim Y, Park J, Lee H *et al.* (2011):** Acupuncture for premenstrual syndrome: a systematic review and meta-analysis of randomised controlled trials. BJOG. An International Journal of Obstetrics & Gynaecology, 118 (8): 899-915.
19. **Feng X, Kuang H, Lin J *et al.* (2021):** Effects of electroacupuncture on the premenstrual syndrome: a randomized clinical trial, J Clin Images Med Case Rep., 2: 12-28.
20. **Parsa P, Bashirian S (2013):** Effect of Transcutaneous Electrical Nerve Stimulation (TENS) on primary dysmenorrhea in adolescent girls.Journal of Postgraduate Medical Institute, 27 (3): 326-330.
21. **Ojoawo A, Esan O, Oloni A (2020):** Effectiveness of Transcutaneous Electrical Nerve Stimulation on Pain and Disability Among Patients with Hip Arthroplasty: A Randomized Control Study of Rehabilitation and Health Studies. https://brieflands.com/articles/mejrh-103662.pdf
22. **Hsieh L, Lee C (2020):** One-shot percutaneous electrical nerve stimulation vs. transcutaneous electrical nerve stimulation for low back pain: comparison of therapeutic effects. American journal of physical medicine & rehabilitation, 81 (11): 838-843.