

EFFECT OF TRANSCUTANEOUS ELECTRICAL NERVE STIMULATION (TENS) ON PRIMARY DYSMENORRHEA IN ADOLESCENT GIRLS

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ABSTRACT

Objectives: Dysmenorrhea is a common problem among female adolescents. The purpose of this study was to examine the effect of high-frequency Transcutaneous Electrical Nerve Stimulation (TENS) on primary dysmenorrhea and to compare it with placebo in a randomized controlled study.

Methodology: Sixty four female aged between 14-18 years at the first day of their menstruation cycle randomly divided in two groups (TENS or placebo TENS). Participants' physical characteristics and menstrual history were recorded. Menstrual pain was measured by self-reported pain intensity using visual analog scale (VAS) before and just after treatment. Paired t-test and independent t-test was conducted to compare pain intensity between pre and post treatment between the two groups (TENS vs. placebo).

Results: The decrease in pain intensity after TENS and placebo TENS were both significant, (Active group: 6.31 to 2.40, $t= 9.70$, $p<0.01$; placebo group: 6.65 to 5.00, $t= 5.97$, $p<0.01$). However, pain intensity in active TENS was significantly decreased than the placebo group ($t=-4.690$, $p=0.000$). Concurrent use of analgesic was reduced significantly in the active TENS ($t= 5.475$, $p<0.01$); but not after placebo TENS.

Conclusions: This result supports that using TENS could be effective in pain reduction among adolescents who suffered from primary dysmenorrhea.

Key Words: Transcutaneous Electrical Nerve Stimulation (TENS), Dysmenorrhea, Menstruation.

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INTRODUCTION

Dysmenorrhea is a common problem in women of reproductive age and the leading cause of recurrent short-term school absence in adolescent girls.

Dysmenorrhea is lower abdominal pain, low back pain with associated symptoms including nausea, fatigue, headache, or diarrhea during menstruation period. In the USA, 50% of women had dysmenorrhea and 10% of them took sick leave for 1–2 days¹. In Iran, previous literature reported more than 80% of female adolescents had dysmenorrhea²⁻³. Besides gynecological problem, economic cost of dysmenorrhea due to absenteeism and loss of labor is expected to be great⁴.

Dysmenorrhea has two types, primary and secondary dysmenorrhea. Primary dysmenorrhea is a painful menstruation in women due to contractions of the uterus which induce ischemia, with normal pelvic anatomy, usually begins during adolescence¹. It is manifested by cramp or colicky pelvic pain beginning with menses and lasting 1-3 days. Secondary dysmenorrhea may be related to pelvic organ pathology such as uterine myoma or ovary cyst^{1,5}.

Non-steroidal anti-inflammatory medications (NSAID), hot pack, oral contraceptive pills, and non-pharmacological methods are mostly used to

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relieve primary dysmenorrhea⁶. However, these methods have some side-effects in some individuals⁷. Transcutaneous electrical nerve stimulation (TENS) is an appropriate method to control dysmenorrhea⁸. A randomized controlled study done by Dawood and Ramos showed that high-frequency TENS was effective to relieve primary dysmenorrhea. However, low-frequency TENS had no effect on pain.⁸ The mechanism of the effect of TENS on primary dysmenorrhea is based on the gate control theory⁹, and the release of endogenous morphine¹⁰.¹¹ In addition, skin stimulation causes local vasodilation in the same dermatome area¹². Therefore, the pain-relieving effect of TENS on primary dysmenorrhea is also to reduce muscle ischemia of the uterus through increased blood flow to the corresponding skin area. "The onset time of pain relief after TENS treatment for primary dysmenorrhea ranges between 20 and 60 sec, far shorter than the 5–10 min that is required for the pain relief effect of musculoskeletal pain"¹³. The purpose of this randomized controlled trial was to apply high-frequency TENS to examine the effects on pain relief in adolescent females who suffers from primary dysmenorrhea, and compare it with the placebo TENS.

METHODOLOGY

A total of 64 female high school students aged between 14-18 years with dysmenorrheal pain participated in this study. All cases were diagnosed as primary dysmenorrhea on the basis of their menstrual history, ultrasound and physical examination done by a gynecologist. Subjects were randomly assigned to active and placebo TENS groups. All subjects were assessed and treated on the first day of their menstruation. This research obtained approval from the local ethical committee. The procedure was fully explained to the participants and their parents and they were required to sign the consent form.

Assessment included recording of menstrual information such as: current age, age at menarche, length of menstrual cycle (interval) and duration of menstrual cycle, severity of pain, location of pain, having pain prior to the start of menses, accompanied complication. Participants were asked whether they had ever used analgesics for menstrual pain (frequency of application and dosages). Subjects were not allowed to take any analgesics before this treatment. Intensity of menstrual pain was evaluated by a 0-10 visual analog scale (VAS), where "0" point indicated "no pain" and "10" indicated "unbearable pain." The VAS evaluations were performed before and just after treatment as the primary outcome. Subjects were followed up until 24 hours to assess the need to take analgesics during this time as the secondary outcome.

In the active group a TENS device (ENRAF NO-NIUS Model, four electrodes) with a frequency of 0- 100/HZ and 90-100 pulse /seconds was applied for 20 minutes, to increase circulation and to have pain relief at the first day of menstrual complaints without taking any analgesics. Patients lied in prone position with a thin pillow placed under their abdomen. Two electrodes were placed to the proximal margin of low back area, and two others were placed to the proximal of gluteal region laterally¹¹. The intensity of stimulation was increased up to the tolerated level without causing any contraction¹³.

The placebo TENS device had exactly the same appearance as the active TENS, but the placebo TENS had no stimulating output. It was applied for a total of 20 minutes in the prone position to the same regions. Same physiotherapist provided both active and placebo TENS applications.

Descriptive statistics were applied to compare groups. To compare pre - post treatment effects in both groups, paired t-test was used. The independent t-test was applied to compare the effect of active TENS vs. placebo. Level of significance was set at $P < 0.05$.

RESULTS

Mean age of the subjects were 16.18 ± 0.97 years and their weight was 43.37 ± 3.89 kg. Mean age at menarche was 12.35 ± 0.93 years. Groups were homogeneous in terms of age, weight, time since menarche, length of menstrual cycle, and duration of menstruation and menstrual pain before treatment Table 1.

All participants complained of pain in their lower abdomen (100%), lower back (93%), and their legs (47%) during first day of menstruation. Other accompanying complaints were headache (95%), vomiting (86%) and diarrhea (12.5%). The most common analgesics used for pain reduction in previous menstruating time were: Mefenamic acid: initial dose:500 mg, followed by 250 mg four times daily (32.8%), followed by Ibuprofen: 400 mg three times daily (29.7%) , Hyosin plus Mefenamic acid (10.9%), and Amp. Hyosin plus Ibo Profen (9.4%), and 17.2% had not taken any analgesics.

Measures of menstrual pain, referred lower abdomen pain, and low back pain at each measurement indicated that differences in the values from the baseline to just after the applications were significant in both treatment groups. Significant improvements in pain relief during the treatment of TENS and placebo TENS were noted with a significant difference between the two groups ($t = -4.69$,

p=0.000). Pain intensity during the cycle of TENS changed from 6.31 before stimulation to 2.40 after stimulation (paired t-test = 9.70, p = 0.000) and during the cycle of placebo TENS, it changed from 6.65 to 5.00 (paired t-test= 5.97, p = 0.000). However, pain intensity in active TENS was significantly decreased than in the placebo group (independent t-test = -4.690, p=0.000) [Table 2].

Concurrent use of analgesic tablets was also significantly reduced (t= 5.475, p<0.01). Active transcutaneous electrical nerve stimulation significantly delayed the need for analgesics by an average of 5.28 hours, compared with 2.42 hours when using placebo TENS (P<0 .01). No adverse effects were observed due to the applications.

Table 1: Comparisons of two groups by participants' characteristics and menstrual history before treatment (n=64)

Participants characteristics	Active TENS (n=32)	Placebo TENS (n=32)	Statistical test	p value
Age (year)	16.40±1.01	15.96±0.89	t=1.830	0.072
Weight (kg)	49.40±3.99	49.34±3.85	t=0.064	0.949
Menstrual history				
Age of menarche (year)	12.37±0.94	12.34±0.93	t=0.133	0.895
Time since menarche(year)	4.03±1.49	3.62±1.03	t=1.264	0.211
Pain duration (day)	2.40±1.56	2.34±1.40	t=0.168	0.867
Menstrual duration	7.18±1.44	6.96±1.20	t=0.657	0.513
Menstrual interval	29.71±1.65	29.59±2.29	t=0.105	0.803
Pain intensity	6.31±2.02	6.62±2.01	t=-0.620	0.583
Pain type				
Colicky	10	5	$\chi^2 = 3.417$	0.181
Cramp	22	27		
Menstrual pattern				
Regular	27	26	$\chi^2 = 0.110$	0.740
Irregular	5	6		
Menstrual flow (bleeding amount)				
Heavy	16	15	$\chi^2 = 0.063$	0.802
Moderate	16	17		
Ever taking analgesic for pain reduction				
Yes	26	27	$\chi^2 = 0.110$	0.740
No	6	5		
Effectiveness of analgesics				
Effective	1	2	$\chi^2 = 0.277$	0.599
Relatively effective	24	25		
Not effective	7	6		

Data are shown as means ± SD and number of cases. None of these factors differed significantly

Table 2: Comparisons of two groups by changes of pain intensity, before and after treatment

Pain intensity (0-10 Scores)	Active TENS (n=32)			Placebo TENS (n=32)		
	Before	After	Differences	Before	After	Differences
	6.312±2.023	2.406±1.682	3.906±2.276*	6.625±2.012	5.000±2.109	1.625±1.539*

*The comparison of pre-post difference of TENS and placebo groups is significant (active: $t=9.705$, $p=0.000$; placebo: $t=5.970$, $p=0.000$) tested by paired t-test. The comparison of difference in the TENS and placebo groups is significant ($t=-4.690$, $p=0.000$) tested by independent t-test.

DISCUSSION

The results of this study indicate that active TENS is effective in reducing dysmenorrheal symptoms. No adverse effects were observed. The results clearly showed the immediate effect in pain relief after the use of TENS and placebo TENS. However, the pain relief effect of active TENS was more significant than that of placebo TENS.

The finding of the present study in the efficacy of high frequency TENS on pain relief was supported by the previous studies^{8, 13-16}. Dawood and Ramos⁸ demonstrated that TENS provided good to excellent subjective pain relief and significantly reduced menstrual flow, diarrhea, clot formation, and fatigue when compared with placebo TENS. They also indicated that TENS provided an appropriate pain relief equivalent to ibuprofen alone. Smith and Heltzel also investigated the effect of TENS on dysmenorrhea, and found it to be helpful in reducing the pain by altering the body's ability to receive or perceive the pain signal¹⁶.

Furthermore, this study has shown improvement in pain through both TENS and placebo TENS. Although, the mechanisms of TENS and placebo TENS in pain relief are different. The mechanism of high-frequency TENS in pain relief is based on gate-control theory or axonal reflex to make vessels around the local organ dilate by stimulating the peripheral nerves. Meanwhile, the mechanism of placebo TENS on pain relief seems to be through the release of endorphin. A previous study showed placebo stimulation and endorphin injection had similar reactions over the cortex area and brainstem for relief the pain¹⁷.

The stimulation intensity of TENS at the largest tolerable level has been proved to bring improvement in pain relief⁸. However, considering taking safety during TENS usage, the stimulation intensity was set by each individual's tolerable level and not to the largest tolerable level¹⁹.

A limitation of this study is that changes in pain could be due to a time effect. Even though, all participants assessed on the first day of menses, there

might be several hours from start of their menses until our treatment initiation, and this may be important when the nature of the menstrual pain is taken into consideration. The participants in the present study were only cases with primary dysmenorrhea and secondary dysmenorrhea was excluded by ultrasound image. Therefore, the findings would be applicable only among women with primary dysmenorrhea.

In clinical use, treatment choice depends on factors including practical use, expense, accessibility, and efficacy. TENS machines are relatively inexpensive, portable, and easy to use devices. Patients can be trained to use TENS themselves and they can self-administer TENS. The results of this trial indicated that TENS was a safe, effective, non-medication method for managing primary dysmenorrhea.

CONCLUSION

Results of this study led us to conclude that TENS method seems to be effective in managing primary dysmenorrhea. It is free from the adverse effects of analgesics, gives immediate pain relief and had no adverse effects.

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CONTRIBUTORS

PP conceived the idea, planned and wrote the manuscript of the study. SB gave input in the write-up of the manuscript. Both the authors contributed significantly to the research that resulted in the submitted manuscript.