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Original Research Article

Effect of High Frequency Transcutaneous Electrical Nerve Stimulation on Dermatomal Site Menstrual Pain among Adolescent Girls with Primary Dysmenorrhea

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ABSTRACT

Background: Primary dysmenorrhea (PD) is a cramping and spasmodic pain in the lower abdomen, back and lower quadrant during the menstruation period. Objective: To evaluate the effect of high TENS on dermatomal level among adolescent girls of PD.
Methodology: 140 adolescent girls of 14-19 years of age were randomly allocated into two groups of Experimental and Control group using sealed opaque envelopes. The data was taken before and after the intervention, the measurement of lower abdominal pain, referred low back pain, and referred bilateral thighs pain was performed by numerical pain rating scale and for the measurement of systolic as well as diastolic blood pressure by aneroid sphygmomanometer.
Results & Conclusion: Paired t-test was applied for within group analysis of outcome variables by Numerical Pain Rating Scale and aneroid sphygmomanometer in both the groups. The between group comparison of outcome variables was analyzed by Unpaired t-test. There was highly significant difference in within group and between group comparison of group A for all the outcome variables (p value <0.001). The study concluded that High frequency TENS at dermatome level show significant improvement for managing primary dysmenorrhea.

Keywords: Dysmenorrhea, Menstruation, Conventional TENS, Adolescence

INTRODUCTION

Adolescence in girls is a stage of transformation from childhood to adulthood (Dhambare et al, 2012). The world adolescent was derived from a Latin word, adolescere that means "growing to maturity" (Agarwal & Agarwal, 2010). Menstrual abnormalities are at high prevalence rate during recent years, which may vary from disturbed menstrual cycle length to disturbance in menstrual blood flow (Boro et al, 2016). Among them, Dysmenorrhea is the most common menstrual abnormality and it is reported that around 60 to 90% of adolescent females have undergone through this problem in their life (Grandi et al, 2012).

Dysmenorrhea is defined as cramping pain in the lower abdomen occurring at the onset or few hours following menstruation (Dawood, 2006). Dysmenorrhea is further classified into two sub-categories namely, Primary and Secondary dysmenorrhea. Primary dysmenorrhea (PD) is defined as painful, spasmodic cramping in the lower abdomen, just before or during menstruation in the absence of any detectable macroscopic

pelvic pathology (Dawood, 1987) whereas Secondary dysmenorrhea is defined as painful menstrual cramps associated with pelvic organ pathology such as uterine myoma or ovary cyst (Hsu et al, 2003). It occurs at any time period between menarche to menopause and its symptoms may not necessarily associate with onset of menstruation. (Habibi et al, 2015).

The present research focuses on adolescent girls of PD, as it is highly prevalent condition in recent years. Methods of treatment for PD include both Pharmacological and Non pharmacological approaches. Non Steroidal Anti-inflammatory Drugs (NSAIDs) and Oral Contraceptives are among the commonly used pharmacological methods. Although there are several side effects to it and some females do not wish to use medications (Dawood et al, 1990; Lacovides et al, 2015; Uttam & Lehri, 2018).

Therefore, a safe & effective non pharmacological management is quite beneficial which include hot pack, biofeedback, spinal manipulation, relaxation techniques, microwave diathermy, infrared ray filament belt and TENS (Transcutaneous Electrical Nerve Stimulation). TENS is a non-invasive device which involves the application of electrical stimulation to the skin. The parameters of TENS include pulse width between 50 µs to 300 µs, frequency in the range of 2Hz to 600 Hz and intensity is between 1-60 milliampere (average intensity till tingling sensation). It has been effectively used in controlling post operative low back pain, labor pain and dysmenorrhea (Shah et al, 2014; Yousef et al 2013).

TENS is classified into two sub-types, High and low frequency TENS. High frequency TENS consists of frequency range between 50 Hz and 120 Hz at a low intensity whereas Low frequency TENS consists of frequency range between 1 Hz to 4 Hz, at high intensity and long pulse width (Mannheimer, 1985; Kaplan, 1997). In 2010, a Cochrane review investigated the effectiveness of high and low frequency TENS for primary dysmenorrhea and reported that high TENS is effective for management of dysmenorrhea (Proctor et al, 2010).

TENS involves the pain gate theory mechanism for pain relief, when high TENS is applied, large diameter fibers in skin get activated & inhibit the small pain carrying fibers input at spinal cord level thereby preventing the pain impulses from transmitting up to brain level. TENS blocks the efferent pain stimulus and this mechanism is based on the effect of high frequency TENS (Shah, 2014; Patel et al, 2016). High TENS also reduce uterine muscle contractions, ischemia and cause vasodilatation via skin stimulation which may further result as fall in blood pressure level that is usually raised during start of menstruation among dysmenorrhea girls (Hughes et al, 1984).

The purpose of the present study is to evaluate the effect of High frequency TENS on dermatomal level at different menstrual pain sites and also on blood pressure level among adolescent girls with PD.

METHODOLOGY

The Present study is a prospective randomized controlled design. The study was conducted in Gurdaspur district of Punjab for a total of one year. 140 adolescent girls between 14-19 years of age were participated in a study. The diagnosis of primary dysmenorrhea was done by a Gynecologist on the basis of their menstrual history and physical examination. The subjects were randomly allocated into two groups using sealed opaque envelopes. The proposal of the study was approved from the local ethical committee. The procedure was fully explained to the subjects and their parents and they were required to sign the written consent form.

The data was collected at baseline, and immediately post treatment for the measurement of lower abdominal pain, referred low back pain, and referred bilateral thighs pain by numerical pain

rating scale and for the measurement of systolic as well as diastolic blood pressure by aneroid sphygmomanometer. The subjects were selected by means of purposive sampling based on inclusion and exclusion criteria.

The inclusion criteria were: Adolescent girls between 14 to 19 years of age, having regular menstrual cycle (length of cycle between 21 to 45 days), girls with primary dysmenorrhea i.e no identifiable gynecologic pathology, Menstrual symptoms must include pain at all three sites (lower abdomen, low back and bilateral thighs). Exclusion criteria were: Adolescent girls diagnosed with secondary dysmenorrhea, mild or infrequent dysmenorrhea, those who use any specific drug or physical method for relief of pain, any cutaneous lesion of anterior abdominal wall.

All subjects were assessed and treated on the first day of their menstruation. Various parameters used in the assessment of subjects were demographic characteristics, menstrual history and anthropometric measurement. Subjects in group A (Experimental group) received high frequency TENS with a frequency of 100 Hz, pulse duration of 80 micro second and intensity up to the tolerated level for a duration of 20 minutes. Subject position was supine lying. The electrodes were placed at T12-L1 dermatome level. Two electrodes were placed at umbilicus level and other two electrodes at Antero superior iliac spine (ASIS) level, both placements were at anterolateral area of pain not higher than umbilicus and lower than ASIS level.

Subjects in Group B (Control group) were given no clinical intervention and a thin pillow was placed under their lower abdomen to attain comfortable position for duration of 20 minutes. The position of the subject was prone lying. After completing the therapeutic intervention session, electrodes were removed and measurement of lower abdominal pain, referred low back pain, referred bilateral thighs pain was re-assessed by using Numerical pain rating scale and blood pressure by aneroid sphygmomanometer immediately after the intervention.

The data were analyzed using Statistical Package for the social sciences (SPSS) 22 version software. Paired t-test was applied for within group analysis of outcome variables (lower abdominal, referred low back, referred bilateral thigh pain by NPRS and systolic as well as diastolic blood pressure by aneroid sphygmomanometer) in both the groups. The between group comparison of outcome variables was analyzed by Unpaired t-test. The results were considered statistically significant if the p value was ≤ 0.05.

RESULTS

Mean decimal age of subjects were 17.01±1.489 years in group A and 17.50± 1.327 years in group B. Mean age at menarche in group A was 12.80±1.269 years and 13.19±1.081 years in group B. There were no significant difference in group A and group B in terms of decimal age, age at menarche, menstrual pain severity and BMI which indicates that homogeneity between the groups was maintained (Table 1).

Table 2 shows the Pre and Post treatment score of NPRS (lower abdomen) between both groups. Table 3 shows the Pre and Post treatment score of NPRS (referred lower back) between both groups. Table 4 shows the Pre and Post treatment score of NPRS (referred bilateral thigh) between both groups. Table 5 shows the Pre and Post treatment score of systolic blood pressure between both groups. Table 6 shows the Pre and Post treatment score of diastolic blood pressure between both groups.

Table 1: Demographic Variables of subjects in both groups

Variables	Group A (Experimental group)	Group B (Control group)	p-value
Decimal age (years)	17.01 ± 1.489	17.50 ± 1.327	0.100
Age at Menarche (years)	12.80 ± 1.269	13.19 ± 1.081	0.136
Menstrual pain severity	7.67 ± 1.472	7.20 ± 1.691	0.083
BMI (kg/m^2)	21.87 ± 1.551	22.10 ± 1.437	0.231

p-value ≤0.05 considered as significant

Table 2: Comparison of Pre and Post treatment score of NPRS (lower abdomen) between both groups

Values	Group A (Experimental group)	Group B (Control group)
Pre-treatment	7.10 ± 1.416	6.97 ± 1.702
Post-treatment	2.29 ± 0.705	6.93 ± 1.645
t value	33.361	1.758
p value	<0.001**	0.083
Mean Difference	4.81 ± 1.207	0.04 ± 0.204
P value	<0.001**	

p value ≤ 0.05 considered as significant; **p value considered as highly significant , NPRS – Numerical Pain Rating Scale

Table 3: Comparison of Pre and Post treatment score of NPRS (referred lower back) between both groups

Values	Group A (Experimental group)	Group B (Control group)
Pre-treatment	7.10 ± 1.505	6.73 ± 1.578
Post-treatment	2.59 ± 0.712	6.66 ± 1.483
t value	27.361	1.927
P value	<0.001**	0.058
Mean Difference	4.51 ± 1.380	0.07 ± 0.310
P value	<0.001**	

p-value ≤ 0.05 considered as significant; **p value considered as highly significant ; NPRS – Numerical Pain Rating Scale

Table 4: Comparison of Pre and Post treatment score of NPRS (referred bilateral thigh) between both groups

Values	Group A (Experimental group)	Group B (Control group)
Pre-treatment	6.43 ± 1.499	6.41 ± 1.707
Post-treatment	2.01 ± 0.807	6.37 ± 1.670
t value	33.279	1.758
p value	<0.001**	0.083
Mean Difference	4.41± 1.110	0.04 ± 0.204
P value	<0.001**	

p-value ≤ 0.05 considered as significant; **p value considered as highly significant; NPRS – Numerical Pain Rating Scale

Table 5: Comparison of Pre and Post treatment score of Systolic blood pressure between both groups

Values	Group A (Experimental group)	Group B (Control group)
Pre-treatment	125.36 ± 5.472	124.43 ± 3.565
Post-treatment	117.90 ± 5.920	124.21 ± 3.472
t value	18.217	1.350
p value	<0.001**	0.182
Mean Difference	7.46± 3.425	0.21 ± 1.329
P value	<0.001**	

p-value ≤ 0.05 considered as significant; **p value considered as highly significant

Table 6: Comparison of Pre and Post treatment score of Diastolic blood pressure between both groups

Values	Group A (Experimental group)	Group B (Control group)
Pre-treatment	84.59 ± 5.696	83.43 ± 3.858
Post-treatment	77.19 ± 5.457	83.21 ± 3.714
t value	19.077	1.758
p value	<0.001**	0.083
Mean Difference	7.40± 3.246	0.21 ± 1.020
P value	<0.001**	

p-value ≤ 0.05 considered as significant; **p value considered as highly significant

DISCUSSION & CONCLUSION

The aim of the present study was to evaluate the effect of high frequency TENS at dermatome level among adolescent girls with Primary dysmenorrhea. The results obtained after the data analysis did not support the null hypothesis as there was strong effect of high frequency TENS both at dermatome level among adolescent girls with Primary dysmenorrhea. The demographic characteristics of subjects including Decimal age (years), Age at menarche (years), menstrual pain severity and body mass index (BMI) (kg/m^2) were all homogenous in nature in both groups (group A and group B) with 70 adolescent girls in each group.

The result postulated that there was highly significant difference in within group and between group comparison of A group for all the outcome variables (NPRS (lower abdomen), NPRS (referred lower back), NPRS (referred bilateral thighs), systolic blood pressure and diastolic blood pressure) whereas, there was non- significant difference for within and between group comparison of group B in all outcome variables (Table 2, Table 3, Table 4, Table 5 and Table 6).

The results of the present study showed the immediate improvement in menstrual pain after the application of high frequency TENS at dermatome level among adolescent girls. The findings of present study are in support with the results of previous studies. Parsa and Bashirian (2013) examined the effect of high-frequency Transcutaneous Electrical Nerve Stimulation (TENS) on primary dysmenorrhea in a randomized controlled study. The results supported that using

TENS could be effective in pain reduction among adolescents who suffered from primary dysmenorrhea. Patel et al (2016) compared the effect of TENS in pre-menstrual phase and during menstrual cycle. The results found that TENS in pre-menstrual phase is more effective for reducing pain than during menstrual cycle.

The present study also demonstrated the effect of high TENS in lowering blood pressure during the start of menstruation in dysmenorrhea. The results of this study are in agreement with the previous study by Hong et al (2011) who reported the use of Infrared rays heating element in lowering blood pressure in dysmenorrhea girls. The mechanism of Infrared rays heating element indicate similarity in TENS mechanism as well in pain relief. The application of TENS also leads to vasodilatation via skin stimulation; reduce ischemia and uterine muscle contractions that may further result as fall in blood pressure level which is usually raised during start of menstruation among dysmenorrhea girls (Hughes et al, 1984).

In primary dysmenorrhea, there is increased endometrial prostaglandin production that leads to increased uterine contractions and ischemic pain during the initial days of menstruation (Habibi et al, 2015; Lacovides et al, 2015). TENS activates large myelinated A alpha and beta fibres which inhibit small nociceptive fibres at the level of dorsal horn of spinal cord which in turn inhibits pain (Shah, 2014).The present study demonstrated significant improvement in Group A (HF-TENS dermatome level) in reducing lower abdomen pain, referred low back pain and referred bilateral thigh pain. There was also fall in systolic and diastolic blood pressure which was raised during the start of menstruation among dysmenorrhea girls. The results show no significant improvement in Group B (Control group)

The study findings indicate that TENS is a safe, efficient and best non pharmacological method for menstrual pain relief in primary dysmenorrhea. The results of the present study concluded that High frequency TENS at dermatome level show significant improvement for managing primary dysmenorrhea.

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