

ORIGINAL RESEARCH ARTICLES

Effectiveness of Transcutaneous Electrical Nerve Stimulation and Interferential Current in Primary Dysmenorrhea

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ABSTRACT

Objective. To compare the effectiveness of transcutaneous electrical nerve stimulation and interferential current in primary dysmenorrhea.

Design. A prospective, randomized, and controlled study.

Setting. Hacettepe University School of Physical Therapy and Rehabilitation.

Patients. Thirty-four volunteer subjects with primary dysmenorrhea (mean age: 21.35 ± 1.70 years) were included. Statistical analyses were performed in 32 subjects who completed all measures.

Interventions. Fifteen subjects received interferential current application for 20 minutes and 17 subjects received transcutaneous electrical nerve stimulation for 20 minutes when they were experiencing dysmenorrhea.

Outcome Measures. Physical characteristics, years since menarche, length of menstrual cycle (days), and duration of menstruation (days) were recorded. Visual analog scale (VAS) intensities of menstrual pain, referred lower limb pain, and low back pain were recorded before treatment, and immediately, 8 hours, and 24 hours after treatment.

Results. Intensities of the evaluated parameters decreased beginning from just after the applications in both groups ($P < 0.05$). Intensity of referring low back pain in first three measurement times was different between the groups ($P < 0.05$), but this difference is thought to be due to the baseline values of the groups. So, it can be said that no superiority existed between the methods ($P > 0.05$).

Conclusion. Both transcutaneous electrical nerve stimulation and interferential current appear to be effective in primary dysmenorrhea. As they are free from the potentially adverse effects of analgesics, and no adverse effects are reported in the literature nor observed in this study, a clinical trial of their effectiveness in comparison with untreated and placebo-treated control groups is warranted.

Key Words. Interferential Current; Transcutaneous Electrical Nerve Stimulation; Dysmenorrhea

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Introduction

Dysmenorrhea is a common gynecologic complaint, with an estimated prevalence range of 50–91% [1]. In Turkey, its frequency is approximately 60–70% reporting some pain, and 10–15%

reporting severe pain sufficient to interfere with daily activities [2]. It is not only a gynecologic problem for women, but also one that affects quality of life and reduces productivity in general [3]. In the United States, dysmenorrhea has been found to be the single most important cause of lost working hours and school absenteeism among young women [1]. Primary dysmenorrhea consists of painful cramps accompanying menstruation, in the absence of any underlying abnormality [4]. The symptoms of dysmenorrhea typically accompany the start of menstrual flow, or occur within a few hours before or after, and last for the first 24–48 hours [1]. Low abdominal pain is usually crampy or colicky, but may be described as a dull constant ache and may radiate to the lower back or legs. Headache, nausea, constipation or diarrhea, and urinary frequency are often present; vomiting occurs occasionally. Premenstrual syndrome symptoms of irritability, nervousness, depression, and abdominal distention may persist during part or all of the menses [3,5,6].

Dysmenorrhea is often underdiagnosed and undertreated. The main approaches to treatment include nonsteroidal anti-inflammatory medications, oral contraceptive pills, and nonpharmacological methods such as physiotherapy and psychological interventions [6].

Transcutaneous electrical nerve stimulation (TENS) is a nonpharmacological and noninvasive pain-relief method that has demonstrated effectiveness for a variety of conditions, including labor pain, primary dysmenorrhea, and pain following obstetric and gynecologic surgery [7,8].

Interferential current (IFC) is another nonpharmacological and noninvasive pain-relief method known to reduce pain and edema in musculoskeletal problems and to increase blood flow and muscle strength in some urogynecologic problems as detrusor instability and urinary stress incontinence [8].

Although studies describing the application of microwave diathermy, spinal manipulation, exercise, acupuncture, and TENS are extensive in literature, there is no study of the effectiveness of IFC on menstrual pain syndrome [8–12]. This study aimed to investigate and compare the effectiveness of TENS and IFC in primary dysmenorrhea.

Materials and Methods

A total of 40 physiotherapy students with dysmenorrheal pain interfering with functioning in activ-

ities of daily living applied via notice board advertisement to participate in this study. In total, 34 were diagnosed by a gynecologist (F.D., MD) as primary dysmenorrhea according to history, physical examination, and ultrasound findings, and were included in the study. Ultrasound findings were used to rule out other conditions. Subjects were randomly assigned into IFC and TENS groups. Two cases were excluded from the study as we could not receive their 8th- and 24th-hour recordings. So, the number of cases was 15 and 17 in IFC and TENS groups, respectively. Because all cases reported dysmenorrhea on the first day of menstruation, subjects were assessed and treated the first day of their menses.

Evaluations

Assessment began with a detailed recording of menstrual information (O.K.), including age, years since menarche, length of menstrual cycle (days), and duration of menstruation (days).

Intensity of menstrual pain was evaluated by a 0- to 100-mm visual analog scale (VAS), where “0” point indicated “no pain” and “100” indicated “unbearable pain.” As low abdominal pain may radiate to low back and legs, which share the same segmental innervations with the uterus, the intensity of referred low back and lower limb pain were similarly evaluated by the VAS. These evaluations were performed before, just after, 8 hours after, and 24 hours after the treatment. Subjects were not allowed any analgesics during this time.

Treatment

Cases in the IFC group had 20 minutes of IFC treatment at the time of menstrual complaints without taking any analgesics. Patients were positioned prone, with a thin pillow placed under their abdomen, for the application. IFC with frequencies of 0–100 and 90–100 pulse/seconds was used (10 minutes each), respectively, to increase circulation (0–100 pulse/seconds) and to have a sedative effect [8]. Polar stimulation with four vacuum electrodes was performed by Electronica Pagani ET20 I Rolandserie (Paderno Dugnano, Italy). Two vacuum electrodes (A1, B1) were placed to the proximal margin of low back area, and the others (A2, B2) to the proximal of gluteal region laterally. The intensity of current was increased up to the tolerated level [8].

Conventional TENS (ITO Model 120 Z two-channel TENS device [ITD Col. Ltd., Tokyo, Japan]) with a frequency of 120 Hz and pulse duration of 100 μ second was applied for a total of

Table 1 Menstrual information of the subjects

	IFC (N = 15) Mean ± SD	TENS (N = 17) Mean ± SD	<i>U</i>	<i>P</i>
Time since menarche (years)	8.47 ± 2.39	8.00 ± 2.03	-0.747	0.455
Length of menstrual cycle (days)	27.33 ± 3.04	27.07 ± 2.66	-0.304	0.761
Duration of menstruation (days)	5.87 ± 1.46	5.12 ± 1.41	-1.137	0.256

U: Mann–Whitney *U*-test.

IFC = interferential current; TENS = transcutaneous electrical nerve stimulation.

20 minutes in the same position to the same regions. The intensity of current was increased up to the tolerated level without leading any contraction [13].

IFC and TENS applications were provided by different physiotherapists (T.A. and N.T., respectively).

Data Analysis

Time-dependent differences were analyzed by repeated measurements, and intergroup differences were analyzed by Mann–Whitney *U*-test. Intragroup differences in each measurement time were analyzed by Wilcoxon signed rank test. Level of significance was set at $P < 0.05$.

Results

Mean age of the subjects was 21.40 ± 1.59 years in the IFC group and 21.29 ± 1.93 years in the TENS group ($U = -0.365$; $P = 0.715$). Body mass index of the subjects were 20.43 ± 1.83 and

$20.15 \pm 2.11 \text{ kg/m}^2$ in IFC and TENS groups, respectively ($U = -0.907$; $P = 0.365$). Groups were homogenous in terms of mean age and, values of body mass index, time since menarche, length of menstrual cycle, and duration of menstruation (Table 1).

Intensities of menstrual pain, referred lower limb, and low back pain decreased beginning just after the applications ($P < 0.05$) (Table 2). Intensity of referring low back pain in first three measurement times was different between the groups ($P < 0.05$), but this result is thought to be due to differences in baseline values (Table 3). Thus, no superiority existed between the methods ($P > 0.05$).

Measures of menstrual pain, referred lower limb 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 ($P < 0.05$). According to the differences from just after to 8 hours and from 8 to 24 hours after the applications, the relief

Table 2 Intragroup differences (mean ± SD) according to the measurement times (in mm)

		Before	Just After	8th Hour	24th Hour	<i>f</i>	<i>P</i>
Menstrual pain	IFC	72.2 ± 16.5	46.9 ± 18.7	39.3 ± 25.8	17.5 ± 19.3	33.12	0.000*
	TENS	79.4 ± 15.6	44.1 ± 27.2	37.1 ± 27.3	21.2 ± 21.2	36.53	0.000*
Referring lower limb pain	IFC	38.9 ± 36.5	17.7 ± 23.5	13.7 ± 15.6	2.0 ± 4.1	5.23	0.015*
	TENS	33.8 ± 30.6	13.4 ± 19.8	11.4 ± 17.1	2.6 ± 6.1	6.35	0.006*
Referring low back pain	IFC	55.9 ± 32.8	31.5 ± 26.5	17.2 ± 13.7	6.7 ± 11.8	12.82	0.000*
	TENS	24.2 ± 24.4	10.3 ± 13.4	7.8 ± 11.9	3.1 ± 5.9	5.02	0.014*

f: repeated measurements.

* $P < 0.05$.

IFC = interferential current; TENS = transcutaneous electrical nerve stimulation.

Table 3 Intergroup differences according to the measurement times

	Before		Just After		8th Hour		24th Hour	
	<i>U</i>	<i>P</i>	<i>U</i>	<i>P</i>	<i>U</i>	<i>P</i>	<i>U</i>	<i>P</i>
Menstrual pain	-1.14	0.251	-0.36	0.719	-0.28	0.776	-0.09	0.923
Referring lower limb pain	-0.40	0.687	-0.81	0.419	-0.85	0.396	0.00	1.000
Referring low back pain	-2.73	0.006*	-2.45	0.014*	-2.05	0.040*	-0.79	0.432

U: Mann–Whitney *U*-test.

* $P < 0.05$.

Table 4 Intragroup analysis of the differences according to each of the measurement times

		IFC		TENS	
		z	P	z	P
Menstrual pain	Baseline: just after	-3.178	0.001*	-3.192	0.001*
	Just after 8 hours	-1.080	0.280	-2.208	0.027*
	8–24 hours	-2.974	0.003*	-2.800	0.005*
Referring lower limb pain	Baseline: just after	-3.301	0.001*	-2.803	0.005*
	Just after 8 hours	-2.271	0.023*	-0.771	0.440
	8–24 hours	-2.691	0.007*	-2.207	0.027*
Referring low back pain	Baseline: just after	-2.936	0.003*	-2.937	0.003*
	Just after 8 hours	-0.889	0.374	-0.459	0.646
	8–24 hours	-2.666	0.008*	-2.371	0.018*

z: Wilcoxon signed rank test.

* $P < 0.05$.

IFC = interferential current; TENS = transcutaneous electrical nerve stimulation.

of pain in each parameter was either maintained ($P > 0.05$) or improved ($P < 0.05$) (Table 4). No adverse effects were observed due to the applications.

Discussion

The results of this study indicate that IFC and TENS are both effective in reducing menstrual pain, referred lower limb pain, and low back pain, which are the common symptoms of dysmenorrhea. No adverse effects were observed, supporting the findings of the related literature [14,15]. However, the interpretation of these results must be considered in light of limitations in the design of the study, particularly the absence of either untreated or placebo control groups. Whether placebo effect or the relaxed position of the subjects during applications play role in the results cannot be determined. The reason for not performing sham applications as controls was that our sample consisted of physiotherapy students familiar with electrotherapy techniques, which made it impossible to perform placebo interventions. Future studies should investigate placebo effects in patients with primary dysmenorrhea who are not familiar with the techniques. A second limitation is that randomization did not allow us to make the groups homogeneous with respect to baseline pain intensities. A third limitation is that changes in pain could be due to a time effect, even though 20 minutes is relatively brief. Finally, in contrast to pharmacological studies, it was difficult to control the start time of the assessments and applications as the techniques were physiotherapist- and device-dependent. Even though patients were all assessed on the first day of menses, there might be several hours from start of menses until study initiation, and this may be very important when the

nature of the menstrual pain is taken into consideration. In the literature, it is reported that pain begins just prior to or with the onset of menstrual flow or within a few hours either way, and resolves with menstruation or may last for just the first 24–48 hours [1,16].

The most critical analyses of this study were differences in pain intensity at baseline and just after the applications. It is more difficult to assess whether other values (8 and 24 hours after the treatment) were directly the results of the applications, as we did not have any untreated/placebo control group.

Although the use of IFC in urinary problems such as incontinence and detrusor instability is presented extensively in the literature, experimental work on the analgesic effects of IFC in dysmenorrhea is sparse. The most common use of IFC is to relieve pain [17,18]. Some authors claim that the amplitude-modulated interference wave is what makes IFC potentially effective, and that, by delivering it at frequencies between 1 and 250 Hz, IFC will elicit a physiological response that leads to pain relief [18]. The present study indicates that IFC leads to pain relief in subjects with dysmenorrhea.

TENS is one of the most common methods investigated for its effects on pain in subjects with dysmenorrhea. Dawood and Ramos [19] demonstrated that TENS provided good to excellent subjective pain relief and significantly reduced diarrhoea, menstrual flow, clot formation, and fatigue when compared with placebo TENS. They also indicated that TENS plus less ibuprofen provided pain relief equivalent to that obtained with ibuprofen alone. They concluded that TENS was a safe, effective, nonmedication method for managing primary dysmenorrhea, and that TENS plus ibuprofen was the best overall treatment, as indi-

cated by the level of pain relief. Smith and Heltzel [20] 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 signal. The results of our study indicate that IFC and TENS are similar in their effects on menstrual pain. These results are similar to those of Johnson and Tabasam [21], who found no differences in the magnitude of analgesia between IFC and TENS in experimentally induced ischemic pain in otherwise pain-free volunteers.

The authors also compared these techniques with the sham electrotherapy group, different from our study, and revealed that there was no change in pain intensity during treatment when all three groups were considered together. However, further analysis indicated that IFC reduced pain intensity to a greater extent when compared with sham electrotherapy, but not, when compared only with TENS.

In clinical settings, selection of treatment usually depends on parameters such as practical use, expense, and achievability, in addition to evidence of efficacy. TENS machines are relatively inexpensive, portable, battery-operated devices, whereas IFC machines are more expensive, are not portable, and require an electrical source. Patients can be trained to deliver TENS themselves and often borrow TENS devices from pain clinics or buy their own stimulator, so that they can self-administer TENS. In contrast, IFC usually requires a therapist and is administered in clinics. Results of this study led us to conclude that both methods seem to be effective in managing primary dysmenorrhea. As they are free from the adverse effects of analgesics and no adverse effects were observed during the study, we believe that a double-blind, randomized, placebo-controlled trial is indicated to establish efficacy.

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