Multimodal Therapy Combining Spinal Manipulation, Transcutaneous Electrical Nerve Stimulation, and Heat for Primary Dysmenorrhea: A Prospective Case Study

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ABSTRACT

Objective: The purpose of this case study was to report the effects of multimodal therapy as an adjunct to oral contraceptives on pain and menstrual symptoms in a patient with primary dysmenorrhea.

Clinical Features: A 27-year old nulligravid and nulliparous woman presented with low back pain, thigh pain, and menstrual symptoms associated with primary dysmenorrhea. Multimodal therapies (spinal manipulation, clinic-based transcutaneous electrical nerve stimulation, and heat applied at home) were delivered over 3 menstrual cycles. Outcome measures included pain (visual analogue scale) and menstrual symptoms (Menstrual Distress Questionnaire) from baseline to follow-up. She continued to take her oral contraceptives throughout the study period.

Intervention and Outcome: For both low back and thigh pain, the patient reported clinically important differences in average pain and worst pain after 2 and 3 months from baseline. There were no clinically important differences in current pain, best pain, or menstrual symptoms at follow-up. No adverse events were reported.

Conclusion: Some of this patient's dysmenorrhea symptoms responded favorably to multimodal therapy over 5 months. The authors observed important short-term reductions in low back and thigh pain (average and worst pain intensity) during care. (*J Chiropr Med* 2018;17:190-197)

Key Indexing Terms: *Dysmenorrhea; Manipulation, Spinal; Manipulation, Chiropractic; Transcutaneous Electric Nerve Stimulation; Combined Modality Therapy*

INTRODUCTION

Primary dysmenorrhea is defined as painful menstruation in the absence of underlying pelvic pathology.¹ Primary dysmenorrhea is a common uterine condition that affects nearly half of reproductive age girls and women.² Previous studies reported a prevalence of primary dysmenorrhea in approximately 45% to 93% of women.³⁻⁶ About 7% to 15% of women reported severe menstrual pain that limited work or daily activities^{3,7,8} or resulted in economic loss.^{9,10}

The etiology of primary dysmenorrhea is not well understood. Evidence suggests that it involves increased endometrial prostaglandin production, basal pressure, and uterine contractions, leading to higher blood flow impedance, uterine vasoconstriction, and subsequent pain.¹¹⁻¹³ Traditionally, treatments have focused on managing these physiological responses, including nonsteroidal anti-inflammatory drugs and oral contraceptive pills.^{14,15} Nonsteroidal anti-inflammatory drugs and oral contraceptive pills reportedly provide substantial benefits to approximately 75% of women with primary dysmenorrhea.^{3,9,10,16-18} However, for women wishing contraception, combined oral contraceptives (specifically those combining ethinyl estradiol and chlormadinone) are preferred, thus eliminating the inherent risks associated with use of nonsteroidal anti-inflammatory drugs.¹³

Approximately 20% of women with primary dysmenorrhea do not receive adequate symptom relief from these pharmacologic treatments.¹⁹ Consequently, some women seek nonpharmacologic treatments for the management of their menstrual symptoms.¹⁹⁻²³ Nonpharmacologic interventions commonly used by women include acupuncture,

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Paper submitted August 17, 2017; in revised form March 22, 2018; accepted March 22, 2018.

1556-3707

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<https://doi.org/10.1016/j.jcm.2018.03.005>

spinal manipulation, transcutaneous electrical nerve stimulation (TENS), and heat application.^{20,24-28} In Australia, approximately 8% to 21% of women with cyclic perimenstrual pain and discomfort often received complementary and alternative medicine from chiropractors or other complementary and alternative medicine providers.²² Moreover, a qualitative study reported that some women experience dissatisfaction with painkillers and oral contraceptives for the management of dysmenorrhea.²⁹ Despite the common use of nonpharmacologic interventions, there is limited evidence of their effectiveness.^{20,24-28}

Most studies examined interventions independently of one another or examined the therapy as an alternative to pharmacologic treatments. Such interventions include spinal manipulation,^{26,30-32} TENS,²⁸ and topical heat.^{27,33,34} Pragmatically, women with primary dysmenorrhea may try a number of therapies concurrently to improve pain and function. Thus, studies examining the effects of multimodal therapies may be more representative of the treatments provided in clinical practice. To the best of the authors' knowledge, no high-quality studies have examined the effectiveness of combined nonpharmacologic therapies in a program of care for the management of women with primary dysmenorrhea.

The purpose of this prospective case study aimed to examine the effects of chiropractic care using multimodal therapy (ie, spinal manipulation, TENS, and heat) as an adjunct to oral contraceptives on pain and menstrual symptoms in a woman with primary dysmenorrhea.

CASE REPORT

The authors conducted a prospective case study in a woman with primary dysmenorrhea by administering multimodal therapy over 3 menstrual cycles. The research ethics board at the Canadian Memorial Chiropractic College, Toronto, Canada approved this study (REB #1103CR3). Written informed consent from the participant and the licence to use the Menstrual Distress Questionnaire (MDQ) were obtained before conducting the study.

Description of Participant

A 27-year old nulligravid and nulliparous female doctor of chiropractic (M.L.) presented with a chief complaint of low back and bilateral thigh pain during her menstrual period. The pain began several months after menarche at age 12 and worsened as she reached 16 years of age. At 16 years of age, her family doctor prescribed oral contraceptive pills (drospirenone 3 mg, ethinyl estradiol 0.03 mg; in tablet form), which reduced the pain. Since the age of 16, her menstrual pain consistently began 2 days prior to menstruation and resolved approximately 5 days after the start of menstruation, with similar character and intensity of pain over the years. She described her pain as a dull ache surrounding the lumbar spine that referred bilaterally to the

anterolateral thighs. Specifically, the pain was located through the entire lumbar spine bilaterally as diffuse widespread discomfort, accompanied by achy pelvic referral pain down the anterolateral thigh. On the second day of menstruation, the pain extended to the superolateral knee and lateral malleolus. The intensity of back and leg pain peaked on day 1 of menstruation and was rated as 45 mm and 15 mm out of 100 mm, respectively. The low back and thigh pain were associated with menstrual headaches starting 2 days before menstruation and lasting approximately 3 days (the menstrual headaches did not occur with ovulation). She did not experience this pain outside of the menstrual cycle. She reported that her menstrual-related pain was severe enough, at times, to miss school, but when she was older, she did not miss work because of the pain. If severe, the pain would awaken her from sleep.

Criteria for primary dysmenorrhea includes the following: (1) confirmation of no pelvic organ pathologies on physical examination, (2) history of primary dysmenorrhea that began within 2 years of menarche, (3) menstrual pain beginning the day before or just after onset of menstrual flow, and (4) regular menstrual cycles (within ± 3 days).^{1,9,35,36} Meeting the classic criteria, her family physician diagnosed her with primary dysmenorrhea at the age of 16. Aside from primary dysmenorrhea, she was in good health. Her annual examinations with her family physician, which included internal pelvic examinations and pap tests, were unremarkable. With no other symptoms or conditions reported (eg, no infections, no intrauterine device used), her family physician found no indications to order imaging or other medical procedures or to refer to a gynecologist. The patient reported a family history of breast cancer on her maternal side. The patient was a nonsmoker, nondrinker, and reported exercising 5 days per week. She had not tried any other treatments for the primary dysmenorrhea. Her family doctor prescribed naproxen for her pain, but the patient preferred to not take any pharmacologic treatment for pain management.

Physical examination was conducted during menses. The examination revealed a height of 157.5 cm and weight of 58 kg (body mass index 23.8) with normal vital signs. Observation revealed mild anterior head carriage but normal thoracic and lumbar curves and a level pelvis. Active and passive lumbar spine motion was full and pain free, except for mild pain on passive extension and bilateral extension, with rotation localized to L4-L5. Hip screen was conducted because the patient report of thigh and leg pain and was unremarkable. Thoracic spine screen revealed mild tenderness on extension in the midthoracic region. Palpation revealed mild tenderness of the erector spinae, quadratus lumborum, quadriceps, and psoas bilaterally, and painful joint restrictions at L4, L5, and sacroiliac joints, bilaterally. Her low back pain was reproduced with orthopedic tests at the sacroiliac joints, bilaterally: Gaenslen, posterior-anterior compression of sacroiliac joints, and Yeoman's. Neurologic examination of the upper and lower extremities was unremarkable.

Fig 1. Study flow diagram.

Study Protocol

This is a case study with a prospective A-B-A design. The study period spanned 5 menstrual cycles (Fig 1). The first menstrual cycle was used to capture baseline values, and no intervention was given. The multimodal intervention was administered during the second, third, and fourth menstrual cycles, and no intervention was given during the fifth menstrual cycle.

The participant was asked to continue using oral contraceptives throughout the study period, but to refrain from any analgesic medication, spinal manipulation, TENS, or other treatment outside of the study. The authors also asked the participant to abstain from physical activity, sexual intercourse, or alcohol consumption 24 hours before treatment. Physical activity has been suggested to relieve menstrual pain in some women, by stretching contracted ligament bands in the abdomen.^{26,27,30,34,37} Similarly, previous studies asked participants to abstain from sexual intercourse prior to treatment.^{30,38} Since alcohol consumption has been postulated to increase pain perception, previous studies have asked participants to refrain from alcohol.^{27,34}

Description of Multimodal Therapy

The multimodal intervention consisting of spinal manipulation, TENS, and topical heat was applied in a

clinical setting. For each menstrual cycle (cycles 2-4), the chiropractor provided the spinal manipulation and TENS 2 days before the start of menstruation, the first day of menstruation, and 2 days after the start of menstruation (ie, day 3 of the menstrual cycle). The authors advised the participant to apply topical heat, as needed, during the menstrual cycle.

Spinal Manipulation

A licensed female chiropractor with 1.5 years in practice, who had not previously treated the participant, delivered spinal manipulation using a high-velocity, low-amplitude thrust to vertebral levels between T10 and S1 segments and to sacroiliac joints as clinically indicated, as determined by manual palpation for joint movement restrictions and tenderness. These vertebral segments are hypothesized to be associated with sensory and motor neural supply to the uterus and theorized to be dysfunctional in patients with dysmenorrhea.³² The procedure performed was in a side-lying position, with the bottom leg straight and in contact with the treatment table. The opposite top knee and hip were flexed and not in contact with the treatment table. This technique aimed to ensure that the spinal manipulation exerted an unopposed force to the selected joint, as utilized by previous studies.^{26,30} The authors collected force measurements during the spinal manipulation procedures for descriptive purposes, using a treatment table with a built-in force plate to measure manipulative force parameters.³⁹ The authors collected force measurements to limit potential concern related to variability of peak forces, and aimed for 200 N to 600 N to reflect the range of peak load forces among chiropractors performing lumbosacral spinal manipulation.^{40,41} Specifically, the systematic review by Downie et al reported manipulative forces in the range of approximately 200 N to 600 N when applied to the lumbopelvic spine.⁴¹ In addition, a previous study by Herzog reported that clinicians applied an average peak force of 400 N when treating the lumbar and sacroiliac joints.⁴⁰

Transcutaneous Electrical Nerve Stimulation

The doctor of chiropractic applied TENS in a quadripolar arrangement at high-frequency (100 Hz, 0.2 msec, comfortable tingling) (TENS ME210, Mettler Electronic Corp, Anaheim, California) for 20 minutes to the painful area in the lower back region. Evidence suggests that this high frequency setting may be effective in treating pain in primary dysmenorrhea.^{42,43} Transcutaneous electrical nerve stimulation sends an electric current that aims to stimulate the nerves and alter the body's ability to receive and understand pain signals.²⁸

Topical Heat

Topical heat was applied at home during menstrual cycles 2 to 4, as pain relief, at the discretion of the

Table 1. Mean Changes^a in Low Back Pain, Thigh Pain, and Menstrual Symptoms Over Time (*n* = 1)

Menstrual Cycle	Low Back Pain (VAS)				Thigh Pain (VAS)				Menstrual Symptoms (MDQ)
	Current Pain Mean (SD)	Average Pain Mean (SD)	Best Pain Mean (SD)	Worst Pain Mean (SD)	Current Pain Mean (SD)	Average Pain Mean (SD)	Best Pain Mean (SD)	Worst Pain Mean (SD)	Mean (SD)
1	25.0 (12.8)	45.3 (6.4)	13.0 (1.7)	80.0 (7.8)	37.0 (3.6)	45.7 (4.9)	15.7 (4.5)	74.7 (11.0)	5.7 (3.2)
2	5.6 (5.5)	50.7 (1.2)	10.6 (6.8)	83.0 (3.6)	23.0 (7.9)	50.3 (1.5)	14.0 (4.3)	85.7 (8.1)	5.7 (3.1)
3	0.3 (0.6)	13.3 (1.5)	1.0 (1.7)	14.7 (2.3)	13.0 (5.3)	20.3 (6.1)	7.7 (2.9)	21.3 (3.8)	2.7 (1.5)
4	5.0 (4.6)	11.3 (8.7)	2.7 (1.5)	22.0 (13.5)	16.0 (6.2)	12.3 (2.3)	5.3 (3.2)	23.0 (11.4)	3.7 (2.1)
5	43.0 (6.6)	42.0 (8.5)	22.0 (17.6)	49.0 (5.3)	47.3 (13.6)	37.7 (6.7)	20.7 (16.6)	57.0 (8.7)	4.7 (4.6)

MDQ, Menstrual Distress Questionnaire; SD, standard deviation; VAS, visual analogue scale.

^a Mean scores across 3 sessions for each menstrual cycle; no intervention was given in menstrual cycles 1 and 5, and the multimodal intervention was administered in menstrual cycles 2 to 4.

participant. The heating device (a microwaveable gel pack) was placed at the pelvic region (depending on the location of pain) to address the pelvic referral patterns of pain, for a duration of 15 minutes daily. A log was completed by the participant to document use of the heated device. Previous studies found topical heat effective for improving pain in women with primary dysmenorrhea, possibly through a form of gate control or central analgesic effect.^{27,34}

Outcome Measures

To coincide with the timing of the intervention, outcomes were captured at the following 3 time points during each menstrual cycle (after the intervention was administered): (1) 2 days before the start of menstruation, (2) day 1 of the menstrual cycle, and (3) day 3 of the menstrual cycle. Moreover, these time points capture the peak onset of symptoms during a menstrual cycle. Symptoms related to primary dysmenorrhea typically occur within a few hours of the start of menstruation and last for the first 24 to 48 hours.^{9,35,36}

Outcome measures included low back pain and lower abdominal and thigh pain (measured on a 100 mm visual analogue scale [VAS]) and menstrual symptoms (measured on MDQ). For the VAS, the participant was asked to rate the “intensity of pain associated with their menstrual period” on a 100 mm VAS, with the anchors of “no pain” (0) and “worst pain imaginable” (100). The authors assessed current pain, average pain, pain at its best (best pain), and pain at its worst (worst pain). The VAS is often used in trials that treat pain as a symptom of certain conditions, including primary dysmenorrhea,^{35,42} and has demonstrated reliability and validity.^{44,45} The MDQ was selected for repeated assessment of the effect of menstrual distress on activities of daily living.^{46,47} The MDQ consists of 46 symptoms and feelings, in which respondents are asked to rate the symptom severity on a 5-point ordinal scale.^{46,47} Moos reported high internal consistencies for pain (Cronbach’s α of 0.84) and autonomic

function (Cronbach’s α of 0.94) with the MDQ.⁴⁷ The VAS and MDQ instruments were independently completed by the participant in a quiet area of the clinic.

The participant was asked to describe the nature of the backache, cramps, or pain during her menstrual cycle in a provided blank diary. This included the date, location or distribution of pain, character of pain, and any other details deemed pertinent by the participant. The participant took the pain diary home and returned it at the end of the study period.

Analysis

For each menstrual cycle, mean VAS and MDQ scores were calculated for the 3 sessions (ie, 2 days before menstruation, first day of menstruation, and 2 days after the start of menstruation). The authors assessed for minimal clinically important differences in outcomes from baseline to follow-up: a change of 30 mm for VAS⁴⁸ and 30% change for MDQ.⁴⁹ Data analysis was conducted by the principal author using SAS software (SAS Institute 2013, Cary, North Carolina).⁵⁰

OUTCOMES

For low back and thigh pain, there were no clinically important differences in mean scores for “current pain” and “best pain” across all menstrual cycles (Table 1, Figs 2 and 3). However, there were clinically important reductions in “average pain” and “worst pain” in menstrual cycles 3 and 4, when compared to baseline for both low back and thigh pain. These differences were not maintained in menstrual cycle 5 (when no multimodal intervention was given). There were no clinically important differences in menstrual symptoms across all menstrual cycles (Fig 4).

In the pain diary, the participant reported consistent use of the heating device, pain relief during the study period, and satisfaction with treatment. With the patient in a side-lying position, the applied spinal manipulations varied between treatments and ranged in location from T10 to S1

Fig 2. Change in low back pain (as measured on VAS) over time ($n = 1$). Participant used oral contraceptives throughout study period; no additional intervention was given in menstrual cycles 1 and 5, and the multimodal intervention was administered in menstrual cycles 2 to 4. VAS, visual analogue scale.

and bilateral sacroiliac joints, as clinically indicated. The average peak force applied for spinal manipulations delivered in menstrual cycle 2 was 319.9 N, 462.1 N for cycle 3, and 327.6 N for cycle 4. No serious or minor adverse events were reported by the participant during the study period. This study did not include any additional follow-up beyond the study period spanning 3 menstrual cycles. The patient consented to have this information published.

DISCUSSION

To the best of the authors' knowledge, this is the first prospective case study to describe the effects of a multimodal therapy combining chiropractic spinal manipulation, TENS, and heat as an adjunct to oral contraceptives for the treatment

of symptoms of primary dysmenorrhea. For low back and thigh pain, the authors found clinically important reductions in average pain and worst pain in menstrual cycles 3 and 4, when compared to baseline. These differences were not maintained in menstrual cycle 5, when no multimodal intervention was administered. There were no clinically important differences in current pain, best pain, and menstrual symptoms at any time point. No adverse events were reported.

Limitations

There are strengths to this study. First, this was a prospective case study, whereby the intervention and outcome measures were determined a priori, and data were collected prospectively. Second, the intervention and outcome assessments were delivered on the most painful days of the menstrual cycle. This timing may be more appropriate for women with primary dysmenorrhea, because the condition is characterized by peak periods of pain around the start of menstruation. Third, the authors used the VAS and MDQ, which are valid and reliable outcome measures. Force measurements were monitored when providing the spinal manipulation to ensure that peak forces applied fell within a range reported for practicing chiropractors. Future research examining the effectiveness of this multimodal therapy for pain relief in patients with primary dysmenorrhea may be warranted.

For limitations, this is a case study involving 1 participant, so it cannot conclude effectiveness of this multimodal therapy. The patient was a chiropractor and also coauthor in this study, so she may have preference for this treatment over other interventions and expected improvement with this multimodal therapy. Therefore, there is potential for high bias in this study. However, she never sought chiropractic treatment for the management of her menstrual symptoms prior to this study nor had precon-

Fig 3. Change in thigh pain (as measured on VAS) over time ($n = 1$). Participant used oral contraceptives throughout study period; no additional intervention was given in menstrual cycles 1 and 5, and the multimodal intervention was administered in menstrual cycles 2 to 4. VAS, visual analogue scale.

Fig 4. Change in menstrual symptoms (as measured on MDQ) over time ($n = 1$). Participant used oral contraceptives throughout study period; no additional intervention was given in menstrual cycles 1 and 5, and the multimodal intervention was administered in menstrual cycles 2 to 4. MDQ, Menstrual Distress Questionnaire.

ceived direction of outcome. The MDQ scores and VAS scores for “current pain” and “best pain” at baseline were low; therefore, the lack of clinically important changes may be due to a floor effect. In addition, a randomized trial by Hondras et al utilized a low force mimic maneuver involving manipulation with a force range of 200 N to 400 N.²⁶ Some of the recorded manipulation forces used in the present case report were in this range; however, this would likely have underestimated any treatment effects seen in this study. Finally, since the patient received a combination of therapies by design, it is unknown whether there was 1 active modality, or if it was the combination of procedures that resulted in benefit to this patient. As this is only a case report, patients with similar findings may not necessarily respond in a similar manner.

Future Studies

Further research to evaluate the effectiveness of this multimodal intervention for the management of primary dysmenorrhea may be warranted. Limited evidence suggests that the combination of spinal manipulation, TENS, and heat may provide short-term pain relief to patients with primary dysmenorrhea, when delivered separately.^{20,24-28} As previous studies investigating these interventions were generally small and had methodological limitations, their effectiveness for the management of primary dysmenorrhea remains unclear. On the other hand, a randomized trial by Hondras et al found similar outcomes between spinal manipulative therapy and sham manipulation for the management of primary dysmenorrhea.²⁶ Given that these interventions aim to affect different mechanisms, it may be warranted to investigate whether these offer an additive effect when administered together. Traditionally, oral contraceptive pills have been reported as decreasing uterine contractions.²⁰ Spinal manipulation target vertebral segments reportedly associated with sensory and motor neural supply to the uterus,³² while both TENS (given during treatment sessions) and topical heat (used at home) aim to alter the body’s ability to receive and understand pain signals.^{20,28} Results from the present case study may help generate hypotheses for future studies investigating multimodal therapies for managing primary dysmenorrhea. Moreover, multimodal therapies may be more representative of treatments provided in clinical practice.

CONCLUSION

In this case study, the patient reported short-term improvements in low back and thigh pain (average and worst pain intensity) after a course of multimodal therapy combining spinal manipulation, TENS, and topical heat as an adjunct to oral contraceptives. No adverse events were reported.

FUNDING SOURCES AND CONFLICTS OF INTEREST

No funding sources or conflicts of interest were reported for this study.

CONTRIBUTORSHIP INFORMATION

Concept development (provided idea for the research) J.J.W., M.L., S.M.

Design (planned the methods to generate the results) J.J.W., M.L., S.M.

Supervision (provided oversight, responsible for organization and implementation, writing of the manuscript) S.M.

Data collection/processing (responsible for experiments, patient management, organization, or reporting data) J.J.W., S.M.

Analysis/interpretation (responsible for statistical analysis, evaluation, and presentation of the results) J.J.W., S.M.

Literature search (performed the literature search) J.J.W.

Writing (responsible for writing a substantive part of the manuscript) J.J.W.

Critical review (revised manuscript for intellectual content, this does not relate to spelling and grammar checking) M.L., S.M.

Practical Applications

- In this prospective case study, a multimodal therapy combining spinal manipulation, transcutaneous electrical nerve stimulation, and topical heat as an adjunct to oral contraceptives appeared to provide short-term improvements in pain (average and worst pain intensity).
- Future research examining the effectiveness of this multimodal therapy for pain relief in patients with primary dysmenorrhea may be warranted.
- Results from our case study may help generate hypotheses for future studies on the management of primary dysmenorrhea.

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