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Original Article

Evaluating Efficacy of Spinal Manipulation on Primary Dysmenorrhea

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Keywords
Dysmenorrhea; Orthopedic manipulation; Lumbosacral regions; Thoracic vertebrae

Abstract

Background: This study was performed to determine the effect of manual spinal manipulation on pain reduction in primary dysmenorrhea.

Methods: The 37 participants were randomly assigned to the intervention and control groups. All patients underwent spinal examinations on day 15 of their cycle. In addition, their lumbosacral range of motion was analyzed using a Zebris machine and their thoracolumbar range of motion was measured using a goniometer. Patients in the intervention group received spinal manipulation on day 15, 21, and 28 of their second menstruation cycle. Patients in both groups performed 6 exercises consisting of stretching and strengthening exercises which were begun on day 15 of their second cycle and stopped with menstruation onset. Follow-up was performed for 3 consecutive cycles in both groups.

Results: Of the 37 patients who entered the study, 32 patients were analyzed. The mean age of patients was 27.68 years and their pain score was generally higher than 5 out of 10. Paired t-test was used for variables with normal distribution and Wilcoxon test for those with non-normal distribution. The pain in the abdomen, pelvis, and lower back was decreased significantly in both groups, but the effect of manipulation + exercise was greater than exercise alone. This reduction in pain in the abdominal and pelvic region after the manipulation was significant in the 3 months of follow-up ($P < 0.05$). Manipulation caused a reduction in diclofenac use in all 3 cycles, but in the exercise group, a significant decrease was only observed in the first cycle. The reduction in the number of days with pain after menstruation was significant after manipulation.

Conclusion: Spinal manipulation seems to be a good alternative to medical therapy with much fewer complications.

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Introduction

Primary dysmenorrhea occurs during menses and presents as pelvic cramping pain. It is neither associated with an organic pathology nor caused by a psychological infirmity. The patients may complain of intermittent spasms about the suprapubic region or pain

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radiating into the low back and legs. Menstrual pain usually begins hours before the onset of bleeding and lasts throughout the first three days of menstruation.[1]

The most common medical treatments for primary dysmenorrhea consist of non-steroidal anti-inflammatory drugs (NSAIDs) or low-dose (high-estrogen) cyclic hormonal birth control. The side effects of medical treatments and their failure rates of 20% to 25% in treating menstrual pain impel many women to search for other treatment options for primary dysmenorrhea.[2-5]

A chiropractic theory explains that spinal manipulation improves the movement of lumbosacral vertebral joints, and therefore, inhibits uterine contraction through sympathetic pathways while enhancing blood flow to the pelvis.

Another chiropractic theory explains that lumbosacral manipulation alters the pelvic pain pathway that induces primary dysmenorrhea.[3,6]

Lower thoracic and upper lumbar segments, and mid-sacral segments innervate the uterus and pelvis in men and women. The afferent and efferent relationship at these cord levels explains the importance of somato-visceral and viscero-somatic reflexes.[7,8]

These vertebral levels comprise the sensory and motor neural supply to the uterus and lower back, and may be the source of pain in dysmenorrheic women if any level is dysfunctional.[1,9]

In a narrative review, Spears has explained that dysmenorrhea is best treated by a multi-modal approach including chiropractic practice, nutrition, medication, and other alternative healthcare practices.[1]

The aim of this study was to evaluate the effect of manipulation on dysmenorrhea and its timing, and determine the appropriate spinal level for manipulation.

Methods

The subjects were referred from a gynecologist with the diagnosis of primary dysmenorrhea and a menstrual pain score of more than 5 out of 10 in the visual analog scale (VAS). The trial took place in the physical medicine and rehabilitation clinic of Imam Reza Hospital, Tehran, Iran. Patients who met the inclusion criteria and agreed to participate in this study signed a consent form.

The study inclusion criteria consisted of ages between 18-45 years, regular cycles (every 28-32 days), symptoms of primary dysmenorrhea in all menstrual cycles during the previous year (minimum duration of symptoms: 1 year), and a score of higher than 5 for all of the primary symptoms (low back pain, general abdominal pain, and pelvic pain) on the VAS for pain associated with dysmenorrhea, lack of use of an intrauterine device (IUD), or oral, implantable, or injectable contraceptives for the duration of the study, and lack of use of analgesics (except diclofenac tablets of 50-150 mg per day) before the onset of and during each menstrual period.

The exclusion criteria consisted of the presence of pelvic inflammatory disease, a history of gastrointestinal bleeding, uterine fibroids, polycystic ovarian syndrome, or any gynecologic cancers. Moreover, subjects who had received manipulation for low back pain during the preceding 6 months, and women who were currently seeking or receiving care at any facility for back or low back pain or for any problem in the thoracolumbosacral region were excluded from the study.

Participants with any contraindication to manipulation, such as a history of spinal fracture or major trauma, other bone pathologies, or morbid obesity, were also excluded from the study. If there was any doubt about contraindications to manipulation, radiographs were obtained to rule out these contraindications.

Subjects filled out a VAS for pain. They received a physical examination that included lumbosacral range of motion tests using a Zebris machine (Zebris Medical GmbH, Germany) and thoracolumbar junction examination using an inclinometer and goniometer by a blinded individual,

neurologic evaluation (consisting of manual muscle testing and sensory evaluation of lower limbs), and abdominal and soft tissue examination by a physician. The physician palpated the piriformis, quadratus lumborum, and erector spinae for trigger points. Patients were randomly assigned to one of two groups: A (manipulation and exercise) and B (only exercise). The groups received the same strengthening and stretching exercise protocol for core muscles.

For all subjects and in all treatment sessions (on the 15th day and at the end of the first, second, third, and fourth cycles), clinicians evaluated the lower back and palpated the soft tissue for trigger points and to identify the spinal segments from T12 to L1 and the L5-S1 joints for manipulation. At these times, the thoracolumbar junction and lumbosacral range of motion were evaluated in all participants using a goniometer and Zebris machine, respectively.

These vertebral levels have the sensory and motor innervation to the uterus and lower back, and can be the source of pain if any level is dysfunctional in dysmenorrheic women.[10,11]

The pelvis and uterine sympathetic efferent fibers descend from the T12-L2 segments. The sensory entrance of the pelvic region is the T12-L2 and S2-4 vertebral segments.[12,13]

All subjects were observed during their first menstrual cycle and were assessed in terms of diclofenac 50 mg use, basal VAS score, and bleeding volume (based on the number of pads used that were provided by the researchers). During the second menstrual cycle, the subjects in group A were treated 3 times according to the following orders. The first, second, and third treatments were performed on day 15, 21, and 28 of their menstrual cycle, respectively. Instructions on exercise were provided for all subjects in both groups A and B on the 15th day of the second cycle. They were instructed to do stretching, flexibility, and strengthening exercises until the end of the second cycle. They did not exercise in the third and fourth cycles. The participants were asked to perform each form of exercise every day of the week and 2 times per day, every time consisting of 10 repetitions. For the first stretching exercise, the subjects were asked to stand, and then flex forward from the trunk so that the shoulders and back were positioned on a straight line and the upper body was parallel to the floor. In the second stretching exercise, the patients had to put one of their legs on the wall; so that their heel was placed on the wall, and then the patient would try to approximate his/her pelvis to the wall. In the third form of stretching exercise, they were asked to open their feet wider than shoulder-width apart, then bend forward and stretch their right hand over their head and touch their left ankle using their right hand. The strengthening exercise included 3 forms; the first one was pelvic bridging, second was cat and camel, and the third was curl up.

Patients in group A were placed in a side-lying position with the lower limbs placed straight on the treatment table. The upper hip and knee were flexed. The manipulation (professor Maigne's method consisting of a high velocity, short-lever, low-amplitude thrust) was delivered to the T12-L1 and L5-S1 vertebral level, bilaterally. After the manipulation, all subjects in groups A and B were instructed to exercise as explained above.

The women were asked to rate the intensity of their menstrual pain on a 0-10 VAS, with the word anchors "no pain" (0) and "worst pain imaginable" (10) at either end of the scale. This scale is frequently used in studies involving the treatment of any condition of which pain is a main symptom, including primary dysmenorrhea.[14-16] Previous studies have showed the reliability and validity of the VAS in the assessment of clinical improvement.[17,18]

The Kolmogorov-Smirnov test was used to verify the normality of the data. In order to evaluate the research hypotheses, the mean comparison test was used. Repeated measures ANOVA was used to investigate the variables

in the 3-month follow-up analysis. In order to compare the variables between the two groups, independent t-test was used in the normal distribution and the Wilcoxon test was used in case of non-normal distribution.

A VAS was completed by each subject on the 15th day of the first cycle, and at the end of the first, second, third, and fourth cycles in both groups. The pre-treatment and post-treatment VAS scores, and thoracolumbar junction and lumbosacral range of motion, and pelvic and low back pain scores were compared between the two groups by means of an independent samples t-test.

Results

From November 2016 to March 2018, 37 women were chosen to participate in the study; 20 patients in the manipulation group (A) and 17 patients in the control group (B). In group A, 3 patients left the study because of early onset of menstruation cycle, exacerbation of low back pain after one treatment session, and school exams. In group B, 2 patients left the study because of not exercising and their long distance from the hospital. The mean age of the participants in group A and B was 27.67 and 27.87 years, respectively.

In group A and B, respectively, 62% and 69% of the patients were students. Moreover, 19% of the total patients were employed. In group A and B, respectively, 19% and 12% of the patients were housewives.

Table 1 shows changes in the studied variables at baseline and in the three consecutive cycles in both groups. Abdominal and low back pain decreased in both groups in the first two cycles, but only decreased in group A in the third cycle. Pelvic pain and diclofenac consumption decreased in both groups in the first cycle, but only decreased in group A in the other cycles. Bleeding volume decreased in group B in the first cycle, but decreased in group A in the second cycle; no statistical difference was observed in the third cycle. No statistically significant decrease was observed in the number of painful days before menstruation. A statistically significant decrease was observed in the number of days with pain after menstruation in the first cycle in group B and in the other cycles in the group. Moreover, the improvement in abdominal and pelvic pain as well as the decrement in diclofenac consumption in group A were statistically significant.

Tables 2, 3, and 4 show changes in lumbosacral range of motion and thoracolumbar junction rotation in 3 consecutive cycles. In the second cycle, improvement of thoracolumbar rotation to the left in group A and lumbosacral rotation to the right and left lateral bending, and thoracolumbar junction rotation to the left in group B were significant. In the third cycle, thoracolumbar rotation to the right was significant in group A. In the fourth cycle, none of the changes in range of motion was significant.

Table 1. Changes in the studied variables at baseline (cycle 1), menstrual cycle 2, menstrual cycle 3, and menstrual cycle 4

Variable		Pretreatment (cycle 1)	Cycle 2	P*	Cycle 3	P*	Cycle 4	P*	P**
Abdominal pain	A	8.33	4.73	< 0.001	5.53	0.003	6.66	0.010	< 0.001
	B	7.25	5.69	0.003	6.56	0.020	6.94	0.40	
Pelvic pain	A	6.33	4.73	0.002	4.27	0.012	4.67	0.031	0.030
	B	6.81	4.56	0.006	5.31	0.110	5.94	0.800	
Low back pain	A	7.07	3.33	0.005	6.37	0.001	5.47	0.018	0.070
	B	6.81	5.06	0.005	5.47	0.048	6.56	0.100	
Diclofenac 50 mg (number)	A	3.93	1.33	0.001	1.53	0.001	2.47	0.017	0.011
	B	4.38	2.44	0.007	3.87	0.263	3.94	0.390	
Bleeding volume	A	15.33	12.66	0.170	11.27	0.020	13.27	0.120	0.090
	B	13.75	10.44	0.020	13.44	0.510	13.75	0.730	
Painful days before menstruation	A	2.80	2.47	0.300	1.93	0.080	2.06	0.100	0.060
	B	2.50	1.18	0.070	2.31	0.200	2.94	0.800	
Painful days after menstruation	A	1.33	1.33	0.200	1.47	0.007	1.27	0.009	0.090
	B	1.62	0.87	0.010	1.37	0.310	2.06	0.700	

P-value *independent sample t-test and Wilcoxon test; A: manipulation group; B: control group; P-value** repeated measures ANOVA

Table 2. Variation in range of motion at baseline (cycle 1) and in the first and second cycles

Variable		Cycles 1-2		
		Mean ± SD	P*	P**
Flexion	A	2.37 ± 1.23	0.500	0.020
	B	-1.18 ± 0.87	0.200	0.800
Extension	A	-2.31 ± 1.06	0.100	0.090
	B	-0.90 ± 0.54	0.300	0.320
Left lateral bend	A	-1.31 ± 0.41	0.260	0.100
	B	-2.20 ± 1.31	0.010	0.130
Right lateral bend	A	-2.12 ± 1.08	0.300	0.010
	B	-2.70 ± 1.65	0.080	0.040
Left rotation	A	-2.56 ± 1.32	0.100	0.140
	B	-1.50 ± 1.31	0.070	0.200
Right rotation	A	-2.37 ± 1.16	0.100	0.200
	B	-1.90 ± 0.94	0.020	0.080
Anterior tilt	A	7.25 ± 2.24	0.200	0.010
	B	-1.50 ± 1.04	0.300	0.060
Posterior tilt	A	-0.43 ± 0.41	0.700	0.800
	B	-0.60 ± 0.33	0.400	0.300
Right thoracic rotation	A	-0.75 ± 0.62	0.100	0.003
	B	-0.12 ± 0.11	0.600	0.300
Left thoracic rotation	A	-1.87 ± 1.15	0.005	0.030
	B	-1.06 ± 0.42	0.010	0.200

*: Independent sample t-rest; A: Manipulation group; B: Control group
**: Repeated measures ANOVA

Table 3. Variation in range of motion from cycle 1 to cycle 3

Variable		Cycles 1-3		
		Mean ± SD	P*	P**
Flexion	A	-2.12 ± 14.50	0.500	0.020
	B	-0.43 ± 2.30	0.400	0.800
Extension	A	-1.80 ± 4.46	0.100	0.090
	B	-0.43 ± 2.70	0.500	0.320
Left lateral bend	A	-1.75 ± 0.40	0.100	0.100
	B	-1.62 ± 3.50	0.080	0.130
Right lateral bend	A	-1.06 ± 4.12	0.100	0.010
	B	-1.10 ± 5.10	0.300	0.040
Left rotation	A	-1.80 ± 5.20	0.100	0.140
	B	-1.00 ± 2.40	0.100	0.200
Right rotation	A	-1.90 ± 5.29	0.100	0.200
	B	-1.10 ± 2.40	0.080	0.080
Anterior tilt	A	7.43 ± 20.73	0.100	0.010
	B	-1.06 ± 5.60	0.600	0.060
Posterior tilt	A	0.50 ± 4.70	0.600	0.800
	B	0.30 ± 2.40	0.600	0.300
Right thoracic rotation	A	-0.80 ± 4.70	0.001	0.003
	B	0.25 ± 0.93	0.300	0.300
Left thoracic rotation	A	-0.75 ± 2.11	0.100	0.030
	B	-0.37 ± 1.14	0.200	0.200

*: Independent sample t-rest; A: Manipulation group; B: Control group
**: Repeated measures ANOVA

Discussion

In the present study, we attempted to eliminate the defects of previous studies, and implement better timing about manipulation and logical levels of manipulation for the treatment of dysmenorrhea. Although there were conflicting therapeutic outcomes in previous studies on the effect of manipulation on dysmenorrhea, in this study, pain reduction was the main outcome observed in women with dysmenorrhea.

In previous studies, due to the differences in timing and amount of required manipulation, manipulation was conducted on days 15, 21, and 28 of the second cycle or before menstruation onset. This timing (chosen manipulation days) may be one of the causes of the significant pain reduction in this study. Spinal manipulation and decreased dysmenorrhea can be an acute result of the effect on pelvic nerve pathways associated with uterine dysfunction, but a longer duration of the intervention may be needed to improve lumbosacral neuromechanical dysfunction, and restoration of normal joint function.

In a study conducted by Holtzman et al., the treatment began on the 21st day post-onset of the last menses.[19] During 2 consecutive menstrual cycles, patients were treated 3 times; the first, second, and third treatment were provided on day 21, days 23-28, and days 1-3 of their menstrual cycle, respectively. They found that primary dysmenorrhea could be decreased by treating the lumbosacral spine using a drop table technique. In this study, there was no control group and the treatment intervention time, small group size, and the participants only consisting of chiropractic students were the limitations of the study. The palliative treatment may be the reason for the decrease in menstrual pain.[19] In the present study, a larger sample size and a control group were used.

In the study by Kokjohn et al., all participants were treated only on day 1 of their cycle through high velocity, low amplitude (HVLA) thrust technique delivered to vertebral levels within T10 and L5-S1. The measurement of outcomes was performed 1 hour after the treatment.

Therefore, no follow-up was performed. The sham treatment position was on one side with bilateral hip flexion. The sham treatment position was perhaps too similar to the manipulative treatment and the amount of force used may still have had a therapeutic effect.[6]

The lack of follow-up was one of the limitations of this study. In the present study, follow-up was conducted in three consecutive cycles. In the study by Cleveland and Wilson, manipulation was conducted on different levels, but no explanation was provided in this regard or regarding the treatment; however, in the present study, the manipulation level was selected according to uterine and pelvic innervations.[6]

Table 4. Variation in range of motion from cycle 1 to cycle 4

Variable		Cycles 1-4		
		Mean ± SD	P*	P**
Flexion	A	-0.80 ± 0.50	0.800	0.020
	B	-0.30 ± 0.18	0.500	0.800
Extension	A	-2.00 ± 1.30	0.060	0.090
	B	-0.10 ± 0.07	0.600	0.320
Left lateral bend	A	-1.10 ± 0.39	0.100	0.100
	B	-0.68 ± 0.28	0.800	0.130
Right lateral bend	A	-0.90 ± 0.58	0.500	0.010
	B	0.25 ± 0.14	0.800	0.040
Left rotation	A	-2.30 ± 1.32	0.050	0.140
	B	0.06 ± 0.04	0.800	0.200
Right rotation	A	-4.40 ± 1.26	0.100	0.100
	B	0.06 ± 0.03	0.080	0.050
Anterior tilt	A	9.80 ± 1.36	0.060	0.050
	B	-0.56 ± 0.42	0.400	0.100
Posterior tilt	A	-1.30 ± 1.06	0.600	0.400
	B	0.43 ± 0.21	0.100	0.080
Right thoracic rotation	A	0.06 ± 0.03	0.400	0.100
	B	-0.06 ± 0.04	0.300	0.080
Left thoracic rotation	A	0.70 ± 0.27	2.200	-0.700
	B	-0.25 ± 0.06	-0.600	0.100

*: Independent sample t-rest; A: Manipulation group; B: Control group
**: Repeated measures ANOVA

In the study by Hondras et al., cycle 1 was the baseline, one treatment was performed on day 1 of cycle 2, three treatments were performed 7-10 days preceding menses in cycles 3 and 4, and treatment was also performed on the first day of menses in cycles 3 and 4. The need for longer treatment time is not mentioned in this study.[20]

Thrust of no more than 400 N was delivered as sham manipulation in this study; it can not been guaranteed that this low force has not led to spinal manipulation.[20]

In the control group, manipulation levels were near the thoracolumbar junction, which was determined based on the previous assumption of its uterine innervation that can be manipulated during the maneuver. In the present study, in order to avoid this problem, the control group did not receive any manipulation and only performed the same exercise routine as the intervention group during the same period.

In total, 14 clinicians participated in the study by Hondras et al.[20] In the present study, in order to control the therapeutic effect of different therapists, all manipulations were performed by the same physician.

In the study by Boesler et al., the HVLA scissors technique was used for lumbosacral and thoracolumbar junctions, articulation for the cervical spine, and isometric and isotonic muscle energy procedures for the hip and pelvis during day 1 of cycle 1.[7] The control group did not receive any treatment; they underwent basic set-up procedures and had a rest period for an equivalent duration of time. In this study, uterine cramp and abdominal pain were significantly reduced compared with the sham group, but detailed information was not provided on this outcome.[7]

In the present study, pelvic, abdominal, and low back pain was significantly reduced.

In the study by Boesler et al., treatment and follow-up durations were short and different levels had been selected for manipulation.[7] In the present study, the manipulation level was selected according to uterine and pelvic innervation, and follow-up duration was longer.

In the study by Snyder and Zhang, after 3 months of treatment, the sham group reported a significant decrease in pain, while in the manipulation group, a significant decrease in pain was observed in the 6-month follow-up.[21] The manipulation technique

used differs from that of the present study.

In their study, the number of treatments received varied for each individual.[21] No information was provided on the consistency of treatment or the parts of the spine that were manipulated. Moreover, there was potential for inconsistency in the way the sensometer was applied. The sham treatment was the same as the experimental treatment, but was performed in areas distinct from those identified by the sensometer. In this study, some patients were treated during one course of treatment that is similar to the current study; however, they did not report the number of treated patients.[22]

From the results of these previous studies, it can be deduced that one course of manipulation treatment can be sufficient.

In the study by Thomason et al., the actual number of visits and treatments varied for each participant.[10] Although the treatment protocol specified 10 treatments in the first month, the actual number of manipulation and sham treatments varied from 2 to 10, and the trial length also varied from 1 to 3 months. No information was presented in the trial on why the participants' number of treatments varied from the set protocol or why some failed to complete the 3 months of treatment.[12]

In their study, the results obtained from each cycle were not reported. Decreased pain between the control group and the treatment group was significant and there is no significant difference between the treatment group and the sham group.[10]

In addition, there was no explanation regarding the extent of subluxation that was the criterion for entry into the study, so a heterogeneous group of patients may have been studied. This issue and the difference in timing of the treatment may be the cause of the difference in the results from that of the present study.[10]

In the present study, the comparison of pelvic, abdominal, and low back pain before and after treatment in both groups showed that they were significantly reduced, but the comparison of the mean difference between the groups showed that the manipulation + exercise effect was greater than the effect of exercise alone. In the third cycle, decreased abdominal and lower back pain was observed in both groups, but this difference was significant in the intervention group. However, the reduction in pelvic pain in the third and fourth cycles was significant only in the intervention group. In the follow-up in the fourth cycle, there was further reduction in the three areas only in the intervention group.

Saleh et al. conducted a comparative study on stretching exercise and core strengthening exercise for 8 weeks and found that pain intensity and duration were significantly decreased in the exercise groups ($P < 0.001$) as compared to the control group, but found no significant differences between the 2 intervention groups.[22]

In the present study, patients were prescribed both types of exercise. In another study, several types of exercise were presented to patients during two menstrual cycles.[23] During the follow-up of the next 2 cycles, a decrease was observed in the severity and duration of dysmenorrhea, which was greater in the second follow-up cycle.[23]

Abbaspour et al. used a series of exercise activities for 20 minutes, twice a day during 4 cycles and recorded a decrease in pain intensity starting in the fourth cycle.[23] A similar decrease was recorded by Onur et al. who studied the effects of a home-based exercise program for 3 cycles.[24] Noorbakhsh et al. administered physical activity for 8 weeks, 3 sessions a week and 90 minutes per session.[25] These studies recorded a decrease in symptoms during each cycle.

In the present study, decreased pain was observed in the control group (exercise group). It showed that exercise was beneficial even for the short period of 2 weeks, while in previous studies, the duration of administration was longer.

Reduction in drug use was significant in both groups. However, by comparing the mean difference, it was found that the effect of

manipulation + exercise was more significant than exercise alone. In the third and fourth cycle, the reduction in drug use was only significant in the intervention group.

Abbaspour et al.[23] and Noorbakhsh et al.[25] noted additional outcomes including a decrease in pain duration (in hours), and decrease in rate and volume of bleeding.

In the present study, there was a decrease in bleeding volume in the control group that received exercises, but it was not significant in three consecutive cycles in either of the groups.

Reduction of the number of painful days before menstruation in both groups was not significant, but reduction in the number of painful days after menstruation was significant in the second cycle in the control group and in the third and fourth cycles in the manipulation group.

Repeated measures ANOVA showed the reduction in diclofenac use, abdominal pain, pelvic pain, right lateral bending, and anterior pelvic tilt to be significant in both groups. Furthermore, changes in the lumbosacral flexion range, and right and left thoracolumbar junction rotation were significant in the manipulation group.

Thus far, previous studies have not investigated the association between the range of motion and dysmenorrhea and in the resultant changes through spinal manipulation.

Kim et al. found increased pelvic torsion in patients with dysmenorrhea, so it may be the cause of change in uterine position, and therefore, pelvic imbalance and increased prostaglandin secretion.[26]

Therefore, considering the hypothesis that manipulation corrects pelvic, thoracolumbar, and lumbar alignment, it can play a role in reducing dysmenorrhea.

Conclusion

Manipulation before menstruation onset on days 15, 21, and 28 of the cycle seems to be a good alternative to medical therapy with much fewer complications. Exercise and manipulation can probably have a synergistic effect on pain reduction. Thoracolumbar junction and lumbosacral level are probably more effective than other levels in pain reduction in dysmenorrhea.

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Conflict of Interest

Authors have no conflict of interest.

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