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Research

Some physiotherapy treatments may relieve menstrual pain in women with primary dysmenorrhea: a systematic review

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KEY WORDS

Primary dysmenorrhea
Dysmenorrhea
Physical therapy modalities
Systematic review

ABSTRACT

Question: In women with primary dysmenorrhoea, what is the effect of physiotherapeutic interventions compared to control (either no treatment or placebo/sham) on pain and quality of life? **Design:** Systematic review of randomised trials with meta-analysis. **Participants:** Women with primary dysmenorrhea. **Intervention:** Any form of physiotherapy treatment. **Outcome measures:** The primary outcome was menstrual pain intensity and the secondary outcome was quality of life. **Results:** The search yielded 222 citations. Of these, 11 were eligible randomised trials and were included in the review. Meta-analysis revealed statistically significant reductions in pain severity on a 0–10 scale from acupuncture (weighted mean difference 2.3, 95% CI 1.6 to 2.9) and acupressure (weighted mean difference 1.4, 95% CI 0.8 to 1.9), when compared to a control group receiving no treatment. However, these are likely to be placebo effects because when the control groups in acupuncture/acupressure trials received a sham instead of no treatment, pain severity did not significantly differ between the groups. Significant reductions in pain intensity on a 0–10 scale were noted in individual trials of heat (by 1.8, 95% CI 0.9 to 2.7), transcutaneous electrical nerve stimulation (2.3, 95% CI 0.03 to 4.2), and yoga (3.2, 95% CI 2.2 to 4.2). Meta-analysis of two trials of spinal manipulation showed no significant reduction in pain. None of the included studies measured quality of life. **Conclusion:** Physiotherapists could consider using heat, transcutaneous electrical nerve stimulation, and yoga in the management of primary dysmenorrhea. While benefits were also identified for acupuncture and acupressure in no-treatment controlled trials, the absence of significant effects in sham-controlled trials suggests these effects are mainly attributable to placebo effects. **[Kannan P, Claydon LS (2014) Some physiotherapy treatments may relieve menstrual pain in women with primary dysmenorrhea: a systematic review. *Journal of Physiotherapy* 60: 13–21]**

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Introduction

Primary dysmenorrhoea is defined as cramping pain in the lower abdomen that occurs just before or during menstruation without identifiable pelvic pathology.[1] Secondary associated symptoms include nausea, vomiting, fatigue, back pain, headaches, dizziness, and diarrhoea.[2] Primary dysmenorrhoea has been reported as the leading cause of recurrent absenteeism from school or work in adolescent girls and young women, and is considered to be a common disorder among women of reproductive age.[3] A survey of 1266 female university students found the total prevalence of primary dysmenorrhoea to be 88%, with 45% of females having painful menstruation in each menstrual period and 43% of females having some painful menstrual periods.[4]

Excessive production and release of prostaglandins during menstruation by the endometrium causes hyper-contractility of the uterus, leading to uterine hypoxia and ischaemia, which are believed to cause the pain and cramps in primary dysmenorrhoea.[3] Based on this understanding, pharmacological therapies for primary dysmenorrhoea focus on alleviating menstrual pain and relaxing the uterine muscles by using non-steroidal anti-inflammatory drugs (NSAIDs) or oral contraceptive pills.[5] A survey of 560 female students from three medical colleges in India reported that 87% of those with dysmenorrhea also sought treatment.[6] Among the women who sought treatment, 73% took analgesics and 58% had physiotherapy management, primarily heat treatment. Managing dysmenorrhea with NSAIDs and oral contraceptives is reported to be associated with side effects such as nausea, breast tenderness, intermenstrual bleeding, and hearing and visual disturbances[7] and in about 20 to 25% of women, menstrual pain has been shown to be inadequately controlled by NSAIDs alone.[8] Therefore, finding an effective non-pharmacological method for relieving symptoms of primary dysmenorrhoea has a significant potential value.

Non-pharmacological, non-invasive, and minimally invasive interventions that have been proposed for obtaining relief from

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dysmenorrhea symptoms include acupuncture and acupressure, biofeedback, heat treatments, transcutaneous electrical nerve stimulation (TENS), and relaxation techniques.[7] Systematic reviews and meta-analyses have been conducted to determine the efficacy of individual physiotherapy interventions on primary dysmenorrhoea. In 2009, a systematic review of trials of TENS reported that high-frequency TENS was effective for the treatment of primary dysmenorrhoea.[9] In 2009, a Cochrane systematic review evaluated three randomised trials on spinal manipulation and concluded that there was no evidence to suggest that spinal manipulation was effective.[10] In 2008, a systematic review of randomised trials of acupressure for primary dysmenorrhoea concluded that acupressure alleviates menstrual pain.[11] Though many reviews have evaluated the efficacy of individual physiotherapy interventions for primary dysmenorrhoea, to our knowledge no reviews have been done to determine the efficacy of physiotherapy modalities in the management of pain and quality of life in primary dysmenorrhoea. In addition, these reviews require updating because new trials of acupressure, acupuncture, and yoga have been published since 2010. Therefore, the research question for this systematic review was:

> In women with primary dysmenorrhea, do physiotherapy interventions reduce pain and improve quality of life compared to a control condition of either no treatment or a placebo/sham?

Methods

Identification and selection of studies

A search of the electronic databases CINAHL, PEDro, EMBASE, Web of Science, Ovid Medline, and AMED was conducted. The publication period searched was from database inception to June 2012. The search strategy for each database is presented in Appendix 1 of the eAddenda. No additional manual searches were performed. Two reviewers independently applied the inclusion criteria presented in Box 1 to all the retrieved studies, and any that clearly did not fulfil these criteria were excluded. If there was any uncertainty regarding the eligibility of the study from the title and abstract, the full text was retrieved and assessed for eligibility. The full text version of all included trials was used for data extraction and methodological quality assessment independently by both the authors. Disagreements were resolved by discussion between the reviewers until consensus was reached. The authors were contacted for any missing data in the included studies.

Box 1. Inclusion criteria.

Design
- Randomised controlled trials

Participants
- Women with primary dysmenorrhea

Interventions
- Acupuncture and acupressure
- Manual therapy, including spinal manipulation
- Electrotherapy, including transcutaneous electrical nerve stimulation
- Massage
- Therapeutic exercise

Outcome measures
- Primary: pain intensity as measured by the VAS and NRS
- Secondary: quality of life

Comparisons
- Physiotherapy intervention versus no treatment
- Physiotherapy intervention versus placebo or sham control

Assessment of characteristics of trials

Quality

The methodological quality of each included trial was assessed by two independent reviewers using the PEDro scale. Trials were not excluded on the basis of quality, although quality was taken into account when interpreting the results. Each item on the scale was scored as either 'yes' or 'no' and the number of items scored as 'yes' (excluding the first item, which relates to external validity) was summed to give a total score out of 10. Trials scoring six or more were considered to be of high quality and trials scoring five or less were considered to be of low quality.

For rating the quality of the evidence, the grading of recommendations assessment, development, and evaluation (GRADE) approach was used. According to this system, the quality of evidence is assessed by rating the outcomes of the trials included in the review. The quality is then categorised as 'high,' 'moderate,' 'low,' or 'very low'.[12] Evidence based on randomised trials begins as high-quality evidence and is downgraded for the following reasons: limitations in conduct and analysis (ie, *risk of bias*) of the studies; *imprecision* of the summary of the estimate of effect; *inconsistency* of the results across the available studies; *indirectness* or poor applicability of the evidence with respect to the populations, interventions, and settings where the proposed intervention may be used;[12] and evidence of *publication bias*.

Downgrading for *risk of bias* could occur for: lack of allocation concealment; non-blinding of participants, personnel, and outcome assessors; incomplete outcome data; selective outcome reporting; or other sources of bias.[13] Non-blinding of participants and therapists was considered to be a major limitation and also resulted in downgrading. In studies with self-reported outcomes, lack of assessor blinding was considered to be a minor limitation and was not downgraded. For judging *precision*, the clinical decision threshold boundary for absolute difference was set at 1%. If this boundary was met, imprecision was not downgraded. If the absolute size excluded this boundary and if the sample size was small, imprecision was downgraded.[14] To inform this decision, the optimum information size was calculated to be 26 in each group, assuming α of 0.05 and β of 0.02. The difference in means between groups was taken as 1.4 cm, based on previous studies. If assessment of *consistency* of results indicated heterogeneity between studies, random-effects models were used for meta-analysis where appropriate. When judging *directness*, studies were downgraded if patients or interventions differed from those of interest.[15] Evidence was rated down for *publication bias* if the individual trials were commercially funded.[16] The overall quality of evidence was then based on the lowest quality rating for the outcome.[17]

Design

Only randomised trials were eligible, including crossover trials if outcome data were available for each intervention prior to the crossover. Studies published in languages other than English and Swedish were excluded.

Participants

The age and pain severity of the participants with primary dysmenorrhoea were recorded to describe the trials. Trials involving participants with secondary dysmenorrhoea, that is, individuals with an identifiable pelvic pathology or chronic pelvic pain, were excluded.

Interventions

Trials that compared different forms of the same treatment (eg, different modes of TENS) were excluded. The effect of physiotherapy had to be distinguishable from the effects of other treatment. For example, where participants were permitted to take analgesics

during the study, analgesic use was required to be consistent for all groups.

Data analysis

For each included study, two reviewers independently extracted the sample size, details of the intervention and control, time points of outcome measurement, and pre- and post-intervention means. Where possible, data presented in other formats were converted to mean and SD for inclusion in meta-analysis. Meta-analysis was carried out for pain intensity immediately post-intervention using Review Manager 5.[18] Separate meta-analyses were completed for no-treatment-controlled trials and for placebo/sham-controlled trials. Weighted mean differences were calculated for the analyses. In the meta-analyses and throughout the Results section, all data from pain scales were converted to a 10-point scale. A fixed-effect model was used where heterogeneity was minimal (as shown by the χ^2 and I^2 values) and otherwise, a random-effects model was used. Statistical significance was set at $p \leq 0.05$.

Results

Flow of studies through the review

The initial searches identified 222 potentially relevant papers. The flow of papers through the process of assessment of eligibility is presented in Figure 1, including the reasons for exclusion of papers at each stage of the process. The specific papers identified within each database by the search strategy are presented in Appendix 1 (See eAddenda for Appenidx 1). We contacted study authors when data were not reported in the format that allowed inclusion in the review.[7] The data could not be obtained in a suitable format, so it was excluded.

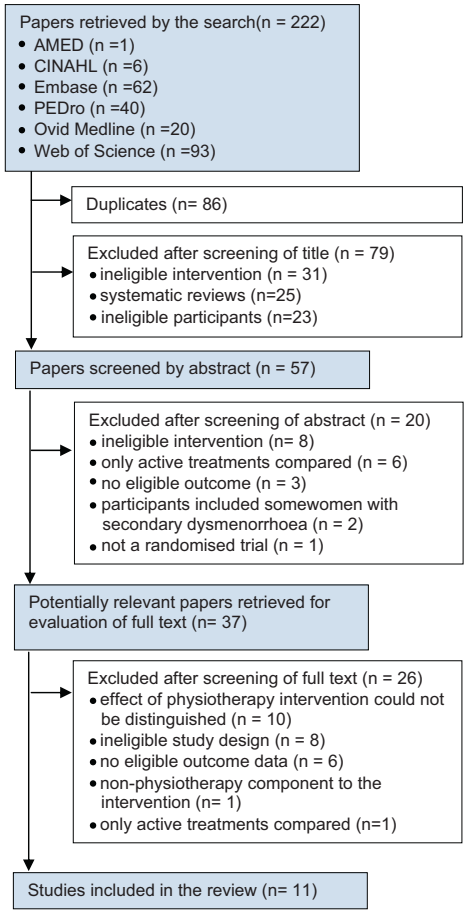

Figure 1. Flow of studies through the review.

Characteristics of included trials

In total, the 11 included trials contributed data on 793 participants. The quality of the included trials is presented in Table 1, the grade of evidence for each outcome is presented in Table 2, and a summary of the included trials is presented in Table 3.

Quality

The methodological quality of the included trials ranged from low to high, with a mean PEDro[36] score of 6.5 out of 10, as presented in Table 1. Six trials[3,19–23] were methodologically high-quality trials with scores ≥6. The individual PEDro items satisfied by fewer than half the trials were concealed allocation (five trials) and those related to blinding, which is discussed in more detail in the next section.

GRADE

As identified by the PEDro scale, GRADE assessment of *risk of bias* showed that only five trials blinded participants,[3,21–24] two trials blinded therapists,[19,23] and four trials blinded assessors.[3,19–21] Acupressure and yoga were the only interventions where the available trials allowed good *precision*. No *inconsistency*, serious *indirectness*, or *publication bias* was identified. The completeness of outcome data for each outcome was adequately described in all the included studies. No other limitations, such as stopping early for benefit or use of unvalidated outcome measures, were identified in any of the included studies. The summary of findings and evidence profile are presented in Table 2. The overall grade of the evidence obtained for the outcome menstrual pain for acupuncture and acupressure trials was 'moderate.' Spinal manipulation and TENS trials obtained 'very low' grades, while heat therapy and yoga trials obtained 'low' grades.

Participants

The sample sizes contributed by the included trials ranged from 20 to 144. The mean age of participants in the included trials ranged from 17 to 34 years.

Interventions

One trial[2] compared the effectiveness of TENS to a placebo pill, two trials[20,21] compared the effect of spinal manipulation to sham manipulation, and one trial[19] compared the effect of continuous low-level heat to a sham heat patch. One trial[25] compared the effect of yoga to no treatment. Two trials[3,23] each compared the effect of acupuncture to two controls: sham treatment (ie, applied to non-acupoints), and no treatment. Four trials investigated the effect of acupressure, with two of these trials applying no treatment to the control group[24,26] and two using sham acupressure as a control.[22,27]

Outcome measures

Two trials measured pain intensity on a numerical rating scale, and nine trials measured the pain intensity on a visual analogue scale (VAS). Although some trials also measured composite scores of pain and other menstrual symptoms, none of the included trials measured a validated quality-of-life score.

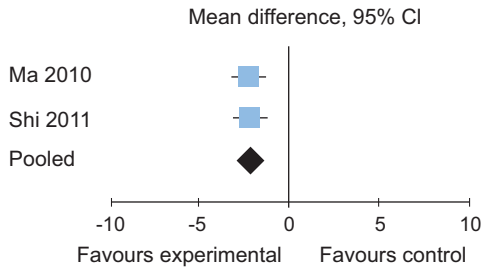

Figure 2. Forest plot of weighted mean difference (95% CI) for pain intensity for acupuncture versus no treatment.

Effect of intervention

Acupuncture versus no treatment

Data were pooled from two methodologically high-quality trials, providing moderate grade evidence comparing the effect of acupuncture with a no-treatment control.[3,23] Both trials measured pain intensity on a VAS. The analysis showed a significant benefit of acupuncture in reducing pain compared to control immediately after treatment, with a weighted mean difference of 2.3 (95% CI 1.6 to 2.9), as presented in Figure 2. A more detailed forest plot is presented in Figure 3, which is available in the eAddenda.

Acupuncture versus sham

The same two trials also compared the analgesic effect of acupuncture with placebo.[3,23] When pain VAS data from the trials were meta-analysed, the weighted mean difference tended to favour the acupuncture group by 1.8; this was not statistically significant (95% CI −0.1 to 3.6), as presented in Figure 4. A more detailed forest plot is presented in Figure 5, which is available in the eAddenda.

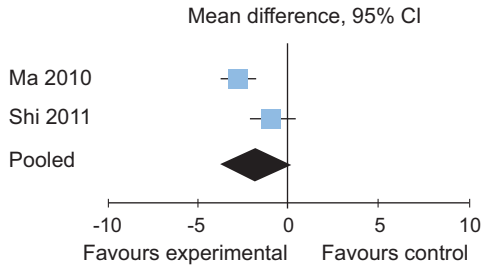

Figure 4. Forest plot of weighted mean difference (95% CI) for pain intensity for acupuncture versus sham acupuncture.

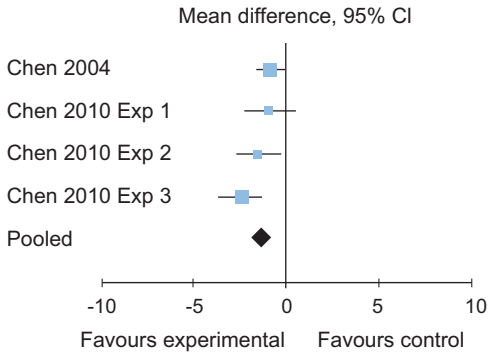

Figure 6. Forest plot of weighted mean difference (95% CI) for pain intensity for acupressure versus no treatment.

Acupressure versus no treatment

Data were pooled from two trials comparing the use of acupressure with control.[24,26] Both trials measured pain intensity on the VAS. The trials provided were methodologically low quality, providing low-grade evidence. The pooled analysis showed a significant benefit of acupressure compared to no treatment, with a weighted mean difference of 1.4 (95% CI 0.8 to 1.9), as presented in Figure 6. A more detailed forest plot is presented in Figure 7, which is available in the eAddenda.

Acupressure versus sham

Two trials compared the effects of acupressure with sham acupressure as a control.[22,27] The trials were methodologically low quality, providing low-grade evidence. The study showed no statistical significance between the groups, with a weighted mean difference of 1.9 (95% CI −0.4 to 4.2), as presented in Figure 8. A more detailed forest plot is presented in Figure 9, which is available in the eAddenda. Note that the trial by Mirbagher-Ajorpaz et al[22]

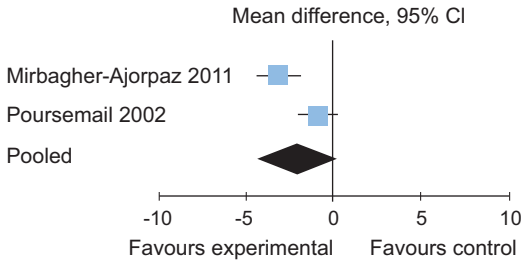

Figure 8. Forest plot of weighted mean difference (95% CI) for pain intensity for acupressure versus sham acupressure.

Table 1
PEDro scores of included trials (n = 11).

Trial	Random allocation	Concealed allocation	Groups similar at baseline	Participant blinding	Therapist blinding	Assessor blinding	<15% dropouts	Intention-to-treat analysis	Between-group difference reported	Point estimate and variability	Total (0–10)
Akin 2001[19]	Y	Y	Y	N	Y	Y	Y	Y	N	Y	8
Chen 2004[26]	Y	N	Y	N	N	N	N	Y	Y	Y	5
Chen 2010[24]	Y	Y	N	Y	N	N	N	Y	N	Y	5
Hondras 1999[20]	Y	Y	Y	N	N	Y	Y	Y	Y	Y	8
Kokjohn 1992[21]	Y	N	Y	Y	N	Y	Y	N	Y	Y	7
Ma 2010[3]	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	9
Mirbagher-Ajorpaz 2011[22]	Y	N	Y	Y	N	N	Y	Y	Y	Y	7
Neighbors 1987[2]	Y	N	Y	N	N	N	Y	N	Y	Y	5
Pouresmail 2002[27]	Y	N	N	N	N	N	Y	Y	Y	Y	5
Rakhshaee 2011[25]	Y	N	Y	N	N	N	N	N	Y	Y	4
Shi 2011[23]	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	9

Table 2
GRADE evidence profile (EP) and summary of findings (SoF).

Quality assessment							Summary of findings				
Number of participants and number of studies	Risk of bias	Inconsistency	Indirectness	Imprecision	Publication bias	Overall quality of evidence	Study event rates (%)		Relative effect (95% CI)	Anticipated absolute effects	
							With control	With intervention		Risk with control	Risk difference with intervention (95% CI)
Manipulation vs. sham – Outcome - menstrual pain (measured with: VAS; range of scores: 0–10; better indicated by lower values)											
182 2 studies[20,21]	Very serious[a]	No serious inconsistency	No serious indirectness	No serious imprecision	Undetected	⊕⊕⊖⊖ LOW[a] due to risk of bias	–	–	–		The mean menstrual pain in the intervention group was 0.6 lower (1.7–0.4 lower)
Acupressure vs. no treatment – outcome-menstrual pain (measured with: VAS; range of scores: 0–10; better indicated by lower values)											
203 2 studies [24,26]	Very serious[b]	No serious inconsistency	No serious indirectness	No serious imprecision	Undetected	⊕⊕⊖⊖ LOW[b] due to risk of bias	–	–	–		The mean menstrual pain in the intervention group was 1.4 lower (1.9–0.8 lower)
Acupuncture vs. no treatment – outcome-menstrual pain (measured with: VAS; range of scores: 0–10; better indicated by lower values)											
46 2 studies [3,23]	No serious risk of bias[c]	No serious inconsistency	No serious indirectness	Serious[d]	Undetected	⊕⊕⊕⊖ MODERATE[d] due to imprecision	–	–	–		The mean menstrual pain in the intervention group was 2.3 lower (2.9–1.6 lower)
Heat therapy vs. sham – outcome-menstrual pain (measured with: NRS; range of scores: 0–100; Better indicated by lower values)											
40 1 study[19]	Serious[e]	No serious inconsistency[f]	No serious indirectness	Serious[d]	Undetected	⊕⊕⊖⊖ LOW[d,e] due to risk of bias and imprecision	–	–	–	The mean menstrual pain in the control group was 4.7	The mean menstrual pain in the intervention group was 1.8 lower (2.7–0.9 lower)
TENS vs. placebo pill – outcome-menstrual pain (measured with: VAS; range of scores: 0–10; better indicated by lower values)											
20 1 study[2]	Very serious[g]	No serious inconsistency[f]	No serious indirectness	Serious[d]	Undetected	⊕⊖⊖⊖ VERY LOW[d,g] due to risk of bias and imprecision	–	–	–	The mean menstrual pain in the control group was 4.1	The mean menstrual pain in the intervention group was 2.3 lower (4.6 to 0.03 lower)

Table 2 (*Continued*)

Quality assessment							Summary of findings				
Number of participants and number of studies	Risk of bias	Inconsistency	Indirectness	Imprecision	Publication bias	Overall quality of evidence	Study event rates (%)		Relative effect (95% CI)	Anticipated absolute effects	
							With control	With intervention		Risk with control	Risk difference with intervention (95% CI)
Acupuncture vs. sham – outcome-menstrual pain (measured with: VAS; range of scores: 0–10; better indicated by lower values)											
46 2 studies[3,23]	No serious risk of bias[c]	No serious inconsistency	No serious indirectness	Serious[d]	Undetected	⊕⊕⊕⊖ MODERATE[d] due to imprecision	–	–	–		The mean menstrual pain in the intervention group was 1.8 lower (3.6 lower to 0.1 higher)
Acupressure vs. sham – outcome-menstrual pain (measured with: VAS; range of scores: 0–10; better indicated by lower values)											
174 2 studies[22,27]	Very serious[h]	No serious inconsistency	No serious indirectness	No serious imprecision	Undetected	⊕⊕⊖⊖ LOW[h] due to risk of bias	–	–	–		The mean menstrual pain in the intervention group was 1.9 lower (4.2 lower to 0.4 higher)
Yoga vs. no treatment – outcome-menstrual pain (measured with: VAS; better indicated by lower values)											
92 1 study[25]	Very serious[i]	No serious inconsistency[f]	No serious indirectness	No serious imprecision	Undetected	⊕⊕⊖⊖ LOW[i] due to risk of bias	–	–	–	The mean menstrual pain in the control group was 2.5	The mean menstrual pain in the intervention group was 3.2 lower (4.2 lower to 2.2 higher)

VAS = visual analogue scale, NRS = numeric rating scale, OIS = optimum information size, TENS = transcutaneous electrical nerve stimulation.

[a] Very serious risk of bias: allocation not concealed, therapist not blinded, and analysis not performed on an intention-to-treat basis in.[21] Participants and therapist not blinded in Hondras et al[20]

[b] Very serious risk of bias: allocation not concealed participants and therapists not blinded in.[26] Therapist not blinded in Chen and Chen.[24]

[c] No serious risk of bias, not downgraded: in Ma et al,[3] acupuncturist was not blinded but the imaging technician was blinded and separated from acupuncturist.

[d] Clinical decision threshold and OIS criterion not met.

[e] Serious risk of bias: Participants not blinded in Akin et al[19]

[f] Not applicable – one trial.

[g] Very serious risk of bias: allocation not concealed, participants and therapists not blinded, and analysis not performed on an intention-to-treat basis, in Neighbors et al[2]

[h] Very serious risk of bias: allocation not concealed, and therapist not blinded in Pouresmail and Ibrahimzadeh[27] and Mirbagher-Ajorpaz et al[22] In addition, participants were not blinded in.[27]

[i] Very serious risk of bias: allocation not concealed, therapist and participant not blinded, and analysis not performed on an intention-to-treat basis in Rakshaee[25].

Table 3
Summary of included trials (n = 11).

Trial	Participants[a,b,c]	Experimental	Control	Pain scale
Akin 2001[19]	n = Exp 20, Con 20 Age (yr) = Exp 33 (6), Con 34 (7) Pain (0–10) = Exp 7.3 (1.4), Con 6.9 (1.4)	Heat patch and placebo tablet	Sham (unheated) patch and placebo tablet	NRS (0–100)
Chen 2004[26]	n = Exp 35, Con 34 Age (yr) = Exp 18 (1), Con 18 (2) Pain (0–10) = Exp 6.5 (1.8), Con 6.5 (1.5)	Acupressure on SP6 point	No treatment	VAS (10 cm)
Chen 2010[24]	n = Exp 1 30, Exp 2 33, Exp 3 36, Con 35 Age (yr) = Exp 1 17 (1), Exp 2 17 (2), Exp 3 17 (2), Con 17 (1) Pain (0–10) = Exp 1 5.5 (1.6), Exp 2 5.1 (1.6), Exp 3 4.9 (1.8), Con 5.5 (1.4)	Acupressure on LI4 point Acupressure on ST36 point Acupressure on LI4 and SP6	No treatment	VAS (10 cm)
Hondras 1999[20]	n = Exp 69, Con 69 Age (yr) = Exp 31, Con 30, (range 18–45) Pain (0–10) = Exp 4.3, Con 3.8	Spinal manipulation	Sham manipulation, ie, low force manoeuvre	VAS (100 mm)
Kokjohn 1992[21]	n = Exp 23, Con 21 Age (yr) = 30, range 20–49 Pain (0–10) = Exp 5.9, Con 6.0	Spinal manipulation	Sham manipulation	VAS (10 cm)
Ma 2010[3]	n = Exp 1 13, Exp 2 14, Con 1 12, Con 2 13 Age (yr) = Exp 1 22 (2), Exp 2 22 (2), Con 1 22 (2), Con 2 23 (3) Pain (0–10) = Exp 1 6.3 (1.4), Exp 2 5.6 (0.9), Con 1 5.9 (1.4), Con 2 6.3 (1.3)	Electroacupuncture on SP6 point Electroacupuncture on GB39 point	Sham electroacupuncture, ie, on non-acupoints No treatment	VAS (100 mm)
Mirbagher-Ajorpaz 2011[22]	n = Exp 15, Con 15 Age (yr) = 22 (2) Pain (0–10) = Exp 5.8 (1.6), Con 5.5 (1.8)	Acupressure on SP6 point	Sham acupressure, ie, touch but no pressure on SP6 point	VAS (10 cm)
Neighbors 1987[2]	n = Exp 10, Con 10 Age (yr) = 25, range 19–38 Pain (0–10) = Exp 4.2 (1.6), Con 4.5 (1.6)	Acupuncture-like TENS	Placebo pill	VAS (10 cm)
Pouresmail 2002[27]	n = Exp 72, Con 72 Age (yr) = range 14–18 Pain (0–10) = Exp 6.1 (SD 1.5), Con 6.0 (SD 1.7)	Acupressure to LI4, SP15, ST36, SP6 and LR3 points	Sham acupressure, ie, on non-acupoints	VAS (10 cm)
Rakshaee 2011[25]	n = Exp 50, Con 42 Age (yr) = Exp 21, Con 20 Pain (0–10) = Exp 8.3, Con 7.8	Yoga	No treatment	NRS (0–3)
Shi et al 2011[23]	n = Exp 10, Con1 10, Con2 10 Age (yr) = Exp 22 (1), Con1 22 (2), Con2 22 (3) Pain (0–10) = Exp 6.0 (1.1), Con1 5.7 (1.0), Con 2 5.7 (1.3)	Acupuncture on SP6 point	Sham acupuncture, ie, on non-acupoint No treatment	VAS (100 mm)

NRS = numerical rating scale, TENS = transcutaneous electrical nerve stimulation, VAS = visual analogue scale.
[a] Age and pain values are mean (SD) unless otherwise stated.
[b] The number of participants stated is the number that provided outcome data.
[c] Pain values are converted to 0–10 scale regardless of how they were recorded.

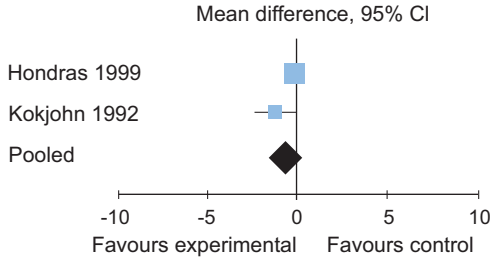

Figure 10. Forest plot of weighted mean difference (95% CI) for pain intensity for spinal manipulation versus sham spinal manipulation.

assessed pain intensity up to 3 hours after treatment and effects were increasingly better, with peak effect reached at 3 hours after treatment.

Manipulation versus sham

Two trials compared the effect of spinal manipulation with sham manipulation as a control.[20,21] The trials were methodologically low quality, providing low-grade evidence. The pooled analysis showed a non-significant benefit of manipulation, with a weighted mean difference of 0.6 (95% −0.4 to 1.7), as presented in Figure 10. A more detailed forest plot is presented in Figure 11, which is available in the eAddenda.

Heat versus sham

One trial compared the effect of a heat pad with a sham (unheated) pad.[19] The trial showed a significant benefit from heat compared to placebo, with a mean difference of 1.8 (95% CI 0.9 to 2.7).

TENS versus placebo pill

One trial compared the analgesic effect of TENS with a placebo pill.[2] The trial showed a significant effect of TENS compared to placebo pill immediately after treatment, with a mean difference of 2.3 (95% CI 0.03 to 4.6).

Yoga versus no treatment

One trial compared the analgesic effect of yoga with no treatment control.[25] Note that the data collected using a 0–3 scale are converted to a 0–10 scale here. The study showed a significant effect

of yoga compared to control at 1 month following treatment, with a mean difference of 3.2 (95% CI 2.2 to 4.2).

Discussion

This systematic review identified statistically significant reductions in pain severity due to several physiotherapy interventions. It is important to interpret the result for each physiotherapy intervention carefully, considering the extent and quality of the evidence obtained, the details of the interventions provided, the estimates of the mean effect on pain obtained derived from the data, and whether the confidence intervals around those estimates include clinically trivial or clinically worthwhile effects.

Among the acupuncture and acupressure trials, we were able to meta-analyse trials where the control group received no treatment separately from placebo- and sham-controlled trials. Comparison of these meta-analyses revealed an interesting pattern. Meta-analysis of the no-treatment controlled trials indicated significant reductions in pain intensity due to acupuncture (by 2.3) and acupressure (by 1.4) on a 0–10 scale. However, the meta-analyses for both acupuncture and acupressure were less promising when the control arm received a sham, with both pooled analyses showing no statistically significant differences between groups. This suggests that the effects of acupuncture and acupressure are mainly attributable to placebo effects.

It is difficult to interpret the relevance of the specific acupoints used. Seven of the 10 experimental interventions in the acupuncture and acupressure trials used the SP6 (Sanyinjiao) acupoint, which is located approximately 4 cm above the medial malleolus, at the posterior border of the medial aspect of the tibia.[22] Most researchers select this because it is the acupoint of choice in gynaecology.[26] It is also easy to locate and apply pressure to SP6 without a clinician's assistance. Among the acupuncture trials, the same results were obtained when different acupoints were used (see Figure 2), but different results were obtained when the same acupoints were used (see Figure 4). In contrast, the forest plot of the no-treatment-controlled trials of acupressure shows a range of effects achieved using four different acupoint locations (see Figure 6).

It is also difficult to interpret the relevance of the specific characteristics of the sham acupuncture. The needling regimens were similar to the active intervention, except that Ma et al[3] did not use evoke De Qi (needle sensation; stimulation of Aδ fibres evoking soreness and/or a motor response 'needle grasp'). Ma et al[3] did not specify their non-acupoints, but Shi et al[23] used a non-meridian acupoint located on the lateral side of lower leg. It is now recognised that needling a few cm away from the acupuncture point may not be a credible placebo.[28,29] A recent trial investigating the reliability of acupuncturists in acupuncture point location suggests that there was up to a 6-cm difference in acupuncture point location between the acupuncturists. Neither study used Streitberger placebo needles, which retract – giving minimal to no stimulation.[30]

The mean estimate of 2.3 reported in the meta-analysis of trials of acupuncture versus no treatment exceeds the clinically significant difference of 2 on the 0–10 scale.[31] However, the confidence intervals around this and the other acupuncture/pressure meta-analyses extend below this threshold, so current evidence does not exclude the possibility that the true effects of these interventions – even when supplemented by placebo effects – may be clinically trivial.

Our meta-analysis of sham-controlled acupressure trials contradicts the systematic review by,[11] which reported that acupressure alleviates menstrual pain. This discrepancy appears due to different inclusion criteria allowing different trials to be included.[11] included a sham-controlled, no treatment-controlled or pharmacological- or non-pharmacological-controlled trials. Their review had a trial where acupressure was compared to ibuprofen and a sham-controlled trial published in Farsi.

Meta-analysis of the two trials of spinal manipulation did not identify a significant effect on pain overall. One of the two trials did achieve a statistically significant benefit, but as the interventions applied in both trials were similar and both used sham manipulation as a control, it is difficult to attribute this to anything other than random variation. Therefore, the result of the meta-analysis provides the best answer: if there is any effect, it is clinically trivial. A similar result was reported by Proctor et al,[10] although that review also allowed the inclusion of data about the chiropractic Toftness adjustment technique.

Heat caused a significant reduction in pain, although this result was derived from only one trial with 40 participants.[19] This was achieved with a 180-cm^2 heat patch capable of supplying 38.9 °C heat for 12 hours per day for 3 days. As noted in Table 2, both groups also received a placebo tablet (because other participants in the trial received ibuprofen). Therefore, even if participants recognised that their patch was unheated, the placebo tablet may have helped to control for placebo effects. The reduction in pain of 1.8 is close to the clinically worthwhile threshold of 2,[31] so further data in this area would be helpful in narrowing the 95% CI, which currently extends up to a clinically worthwhile 2.7 and down to a clinically trivial 0.9 on the 0–10 scale.

The evidence about TENS had similarities to the evidence about heat. It was derived from one small trial; the best estimate of the effect (ie, 2.3) was similar to the clinically worthwhile threshold; and the 95% CI extended well above and below this threshold. This result contradicts that of Proctor et al,[9] who pooled the results of three studies and concluded that TENS had no statistically significant effect, although their analysis was based on the odds of obtained threshold pain reduction. To achieve the result observed in our review, Neighbors et al[2] delivered TENS at a rate of 1 pulse per second with pulse width 40 μs for 30 minutes. Low-rate TENS delivered at a frequency of 2 Hz is believed to induce analgesic effect through an endorphin-mediated mechanism.[32]

The yoga intervention assessed a set of three simple postures (cobra, cat, and fish) executed in a 20-minute session daily during the luteal phase. The mean reduction in pain (3.2) and the 95% CI limits (2.2 to 4.2) were all above the clinically worthwhile threshold of 2.[31] However, this result was derived from a single study with a PEDro score of 4, so replication of this result in other studies of yoga and perhaps other exercise regimens should be sought. One study of a 30-minute walk/jog regimen 3 days per week found a benefit for dysmenorrhoea,[33] although it was not eligible for this review because the outcome was a composite symptom score.

Although the analgesic benefits of heat, TENS, and yoga were statistically significant, the evidence for each intervention came with minor caveats. All estimates were provided by only a single trial, the confidence interval did not exclude the possibility that the effect was clinically trivial, and the quality of the trial was low. However, these interventions have relatively low costs and risks, so some women with dysmenorrhoea may wish to try them despite these uncertainties.

This systematic review has several strengths. Two reviewers independently performed study selection, quality assessment, and data extraction. Statistically significant benefits were identified for several interventions. Important insights into placebo effects were identified by the separation of sham-controlled trials from trials with no-treatment controls. A possible limitation is that the search did not include grey literature, which is more likely to report no statistical significance between groups.[34,35] This may temper the positive nature of the evidence of efficacy reported in this review. Although there was also potential for language bias, the 13 non-English, non-Swedish articles were excluded for other reasons

during the abstract screening. Therefore, language bias was not a limitation. The average PEDro score was within the range we nominated as high quality, and the rarely achieved blinding items on the PEDro scale were met, with blinding of participants (5 trials), assessors (4 trials), and therapists (2 trials).

In conclusion, this review identified that heat, TENS, and yoga can each significantly reduce the pain of dysmenorrhoea. The magnitude of these effects may or may not be clinically worthwhile, but as the costs and risks of these interventions are low, they could be considered for clinical use. The review also identified moderate-grade evidence to support the use of acupuncture and acupressure, although this may be due to a placebo effect. Although one study identified a part from spinal manipulation, the weight of evidence was that it was not effective. Data from further research on these and other interventions, such as whole body exercise, could help to provide more precise estimates of the average effects of physiotherapy interventions for dysmenorrhoea.

What is already known on this topic: Many women of reproductive age experience dysmenorrhea. Although medications are available to treat the pain, these produce side effects or incomplete pain relief in a substantial proportion of women with dysmenorrhea. Several physiotherapy interventions have been investigated as non-pharmacological interventions for dysmenorrhea.
What this study adds: Although acupuncture and acupressure reduced pain severity in dysmenorrhea, this appears to be a placebo effect. Heat, transcutaneous electrical nerve stimulation, and yoga each significantly reduced pain severity, but spinal manipulation did not.

eAddenda: Figures 3, 5, 7, 9 and 11 and Appendix 1 can be found online at doi:10.1016/j.jphys.2013.12.003

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