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[Intervention Review]

Acupuncture for treating fibromyalgia

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ABSTRACT

Background

One in five fibromyalgia sufferers use acupuncture treatment within two years of diagnosis.

Objectives

To examine the benefits and safety of acupuncture treatment for fibromyalgia.

Search methods

We searched CENTRAL, PubMed, EMBASE, CINAHL, National Research Register, HSR Project and Current Contents, as well as the Chinese databases VIP and Wangfang to January 2012 with no language restrictions.

Selection criteria

Randomised and quasi-randomised studies evaluating any type of invasive acupuncture for fibromyalgia diagnosed according to the American College of Rheumatology (ACR) criteria, and reporting any main outcome: pain, physical function, fatigue, sleep, total well-being, stiffness and adverse events.

Data collection and analysis

Two author pairs selected trials, extracted data and assessed risk of bias. Treatment effects were reported as standardised mean differences (SMD) and 95% confidence intervals (CI) for continuous outcomes using different measurement tools (pain, physical function, fatigue, sleep, total well-being and stiffness) and risk ratio (RR) and 95% CI for dichotomous outcomes (adverse events). We pooled data using the random-effects model.

Main results

Nine trials (395 participants) were included. All studies except one were at low risk of selection bias; five were at risk of selective reporting bias (favouring either treatment group); two were subject to attrition bias (favouring acupuncture); three were subject to performance bias (favouring acupuncture) and one to detection bias (favouring acupuncture). Three studies utilised electro-acupuncture (EA) with the remainder using manual acupuncture (MA) without electrical stimulation. All studies used 'formula acupuncture' except for one, which used trigger points.

Low quality evidence from one study (13 participants) showed EA improved symptoms with no adverse events at one month following treatment. Mean pain in the non-treatment control group was 70 points on a 100 point scale; EA reduced pain by a mean of 22 points (95% confidence interval (CI) 4 to 41), or 22% absolute improvement. Control group global well-being was 66.5 points on a 100 point scale; EA improved well-being by a mean of 15 points (95% CI 5 to 26 points). Control group stiffness was 4.8 points on a 0 to 10 point; EA reduced stiffness by a mean of 0.9 points (95% CI 0.1 to 2 points; absolute reduction 9%, 95% CI 4% to 16%). Fatigue was 4.5 points (10 point scale) without treatment; EA reduced fatigue by a mean of 1 point (95% CI 0.22 to 2 points), absolute reduction 11% (2% to 20%). There was no difference in sleep quality (MD 0.4 points, 95% CI -1 to 0.21 points, 10 point scale), and physical function was not reported.

Moderate quality evidence from six studies (286 participants) indicated that acupuncture (EA or MA) was no better than sham acupuncture, except for less stiffness at one month. Subgroup analysis of two studies (104 participants) indicated benefits of EA. Mean pain was 70 points on 0 to 100 point scale with sham treatment; EA reduced pain by 13% (5% to 22%); (SMD -0.63, 95% CI -1.02 to -0.23). Global well-being was 5.2 points on a 10 point scale with sham treatment; EA improved well-being: SMD 0.65, 95% CI 0.26 to 1.05; absolute improvement 11% (4% to 17%). EA improved sleep, from 3 points on a 0 to 10 point scale in the sham group: SMD 0.40 (95% CI 0.01 to 0.79); absolute improvement 8% (0.2% to 16%). Low-quality evidence from one study suggested that MA group resulted in poorer physical function: mean function in the sham group was 28 points (100 point scale); treatment worsened function by a mean of 6 points (95% CI -10.9 to -0.7). Low-quality evidence from three trials (289 participants) suggested no difference in adverse events between real (9%) and sham acupuncture (35%); RR 0.44 (95% CI 0.12 to 1.63).

Moderate quality evidence from one study (58 participants) found that compared with standard therapy alone (antidepressants and exercise), adjunct acupuncture therapy reduced pain at one month after treatment: mean pain was 8 points on a 0 to 10 point scale in the standard therapy group; treatment reduced pain by 3 points (95% CI -3.9 to -2.1), an absolute reduction of 30% (21% to 39%). Two people treated with acupuncture reported adverse events; there were none in the control group (RR 3.57; 95% CI 0.18 to 71.21). Global well-being, sleep, fatigue and stiffness were not reported. Physical function data were not usable.

Low quality evidence from one study (38 participants) showed a short-term benefit of acupuncture over antidepressants in pain relief: mean pain was 29 points (0 to 100 point scale) in the antidepressant group; acupuncture reduced pain by 17 points (95% CI -24.1 to -10.5). Other outcomes or adverse events were not reported.

Moderate-quality evidence from one study (41 participants) indicated that deep needling with or without *deqi* did not differ in pain, fatigue, function or adverse events. Other outcomes were not reported.

Four studies reported no differences between acupuncture and control or other treatments described at six to seven months follow-up.

No serious adverse events were reported, but there were insufficient adverse events to be certain of the risks.

Authors' conclusions

There is low to moderate-level evidence that compared with no treatment and standard therapy, acupuncture improves pain and stiffness in people with fibromyalgia. There is moderate-level evidence that the effect of acupuncture does not differ from sham acupuncture in reducing pain or fatigue, or improving sleep or global well-being. EA is probably better than MA for pain and stiffness reduction and improvement of global well-being, sleep and fatigue. The effect lasts up to one month, but is not maintained at six months follow-up. MA probably does not improve pain or physical functioning. Acupuncture appears safe. People with fibromyalgia may consider using EA alone or with exercise and medication. The small sample size, scarcity of studies for each comparison, lack of an ideal sham acupuncture weaken the level of evidence and its clinical implications. Larger studies are warranted.

PLAIN LANGUAGE SUMMARY

Acupuncture for fibromyalgia

This summary of a Cochrane review presents what we know from research about the effect of acupuncture on fibromyalgia.

The review shows that in people with fibromyalgia:

- acupuncture is probably better than non-acupuncture treatment in reducing pain and stiffness and improving overall well-being and fatigue;

- acupuncture with electrical stimulation is probably better than needling alone in reducing pain and stiffness, and improving overall well-being, sleep and fatigue;

- acupuncture without electrical stimulation probably does not reduce pain or improve fatigue, overall well-being or sleep; and

- acupuncture probably enhances the effect of drugs and exercise on pain.

What is fibromyalgia and what is acupuncture?

When you have fibromyalgia, you experience pain in many sites of your body, with a range of other symptoms including joint stiffness, sleep disturbance, fatigue and mood disorders, which affect the quality of life. There is no cure and few treatment options for fibromyalgia at present, so the treatments aim to relieve pain and improve your well-being and the ability to function.

Acupuncture is a form of Chinese medicine and uses fine needles to stimulate certain areas of the body, called acupuncture points. Acupuncture is commonly used by people to reduce various forms of pain. It works by reducing inflammation, stimulating the release of your body's own pain killer, that is endorphins, and calming your brain. It is safe with few, short-lasting side effects. If supported by the overall body of evidence, acupuncture will offer much needed effective symptom relief for fibromyalgia.

Best estimate of what happens to people with fibromyalgia who use acupuncture:

Comparing acupuncture with sham interventions

Pain (higher scores mean worse or more severe pain)

- People who had needle acupuncture with electrical stimulation rated their pain to be 13 points lower on a 100-point scale (absolute improvement) after six sessions of treatment.

- People who had fake acupuncture rated their pain to be 70 on a scale of 0 to 100 at the end of treatment.

- People who had needle acupuncture with electrical stimulation rated their pain to be 57.

Physical function (higher scores mean better function):

- People who used needle acupuncture without electrical stimulation rated their physical function to be six points lower (absolute deterioration).

- People who had fake treatment rated their physical function to be 28 on a scale of 0 to 100 at the end of treatment.

- People who had needle acupuncture without electrical stimulation rated their physical function to be 22.

- There are no data on needle acupuncture with electrical stimulation.

Global well-being rated by participants (higher scores mean better function):

- People who had needle acupuncture with electrical stimulation rated their well-being to be 11 points higher (absolute improvement).

- People who had fake treatment rated their well-being to be 41 on a scale of 0 to 100 at the end of treatment.

- People who had needle acupuncture with electrical stimulation rated their well-being to be 52.

Sleep (higher scores mean better sleep):

- People who used acupuncture rated their sleep to be eight points higher (absolute improvement).

- People who had fake treatment rated their sleep to be 30 on a scale of 0 to 100 at the end of treatment.

- People who had needle acupuncture with electrical stimulation rated their sleep to be 38.

Fatigue (higher scores mean more severe fatigue):

- People who had needle acupuncture with electrical stimulation rated their fatigue to be 15 points lower (absolute improvement).

- People who had fake treatment rated their fatigue to be 78 on a scale of 0 to 100.

- People who had needle acupuncture with electrical stimulation rated their fatigue to be 63.

Stiffness (higher scores mean more severe stiffness):

- People who had needle acupuncture with electrical stimulation rated their stiffness to be nine points lower (absolute improvement).

- People who had fake treatment rated their stiffness to be 66 on a scale of 0 to 100 at the end of treatment.

- People who had needle acupuncture with electrical stimulation rated their stiffness to be 57.

- Data on needle acupuncture without electrical acupuncture were not available.

Adverse effects:

- One in six people who had acupuncture reported adverse events.

- One in three people who had fake treatments reported adverse events.

- Overall, such events were minor and lasted less than one day.

Acupuncture as an adjunct therapy

Pain (higher scores mean more severe pain):

- People who had needle acupuncture in addition to a standard treatment of exercise and medication (antidepressants) rated their pain to be 30 points lower on a scale of 0 to 100 (absolute improvement) after 20 sessions of acupuncture.

- People who had standard therapy rated their pain to be 80 on a scale of 0 to 100 at the end of treatment.

- People who had additional acupuncture treatment rated their pain to be 50.

Acupuncture compared with antidepressants

Pain (higher scores mean more severe pain):

- People who had acupuncture rated their pain to be 17 points lower (absolute improvement) after 28 sessions of acupuncture.

- People who had antidepressants rated their pain to be 29 on a scale of 0 to 100 at the end of treatment.

- People who had acupuncture treatment rated their pain to be 12.

Comparing acupuncture with non-acupuncture (wait list)

- People who had needle acupuncture with electrical stimulation rated 23, 11 and 9 points lower on a 100-point scale for pain, fatigue and stiffness, respectively; and reported their global well-being to be 15 points better than those who did not have acupuncture.

SUMMARY OF FINDINGS

Summary of findings for the main comparison. Acupuncture versus non-acupuncture for treating fibromyalgia

Acupuncture versus non-acupuncture for treating fibromyalgia

Patient or population: patients with fibromyalgia

Settings: Japan[1]

Intervention: acupuncture versus non-acupuncture

Outcomes	Illustrative comparative risks* (95% CI)		Relative effect (95% CI)	No of participants (studies)	Quality of the evidence (GRADE)	Comments
	Assumed risk	Corresponding risk				
	Non-acupuncture	Acupuncture (EA)				
Pain up to 1 month after treatment VAS[2]	No treatment **69.8 points** Scale (0 to 100)	EA **47.4 points** (Lower score indicates less pain) **22.4 MD lower** (40.98 lower to 3.82 lower)		13 (1 study)	⊕⊕⊖⊖ **low[4]**	**AR %** -22.40% (-40.98% to -3.82%) **RR %** -30.19% (-55.23% to -5.15%) **NNT 4** (1 to 161)
Physical function	Not reported					Not reported
Global well-being up to 1 month after treatment FIQ[3]	No treatment **66.5 points** Scale (0 to 100)	EA **51.1 points** (Lower score indicates better well-being) **15.4 MD lower** (25.62 lower to 5.18 lower)		13 (1 study)	⊕⊕⊖⊖ **low[4]**	**AR %** -15.40% (-25.62% to -5.18%) **RR %** -23.88% (-39.72% to -8.03%) **NNT 4** (1 to 52)
Sleep up to 1 month after treatment Subset (rest) FIQ[3]	No treatment **4.0 points** Scale (0 to 10)	EA **3.6 points** (Lower score indicates better sleep) **0.4 MD lower**		13 (1 study)	⊕⊕⊖⊖ **low[4]**	**AR %** -4.00% (-10.10% to 2.10%) **RR %** -10.53% (-26.58% to 5.53%) **NNT** N/A

		(1.01 lower to 0.21 higher)				
Fatigue up to 1 month after treatment Subset (fatigue) FIQ[3]	No treatment **4.5 points** Scale (0 to 10)	EA **3.4 points** (Lower score indicates less fatigue) **1.1 MD lower** (1.98 lower to 0.22 lower)		13 (1 study)	⊕⊕⊖⊖ **low[4]**	**AR %** -11.00% (-19.80% to -2.20%) **RR %** -26.19% (-47.14% to -5.24%) **NNT** 4 (1 to 52)
Stiffness up to 1 month after treatment Subset (stiffness) FIQ[3]	No treatment **4.8 points** Scale (0 to 10)	EA **3.9 points** (Lower score indicates less stiffness) **0.9 MD lower** (1.66 lower to 0.14 lower)		13 (1 study)	⊕⊕⊖⊖ **low[4]**	**AR %** -9.00% (-16.60% to -1.40%) **RR %** -21.95% (-40.49% to -3.41%) **NNT** 3 (1 to 128)
Adverse events			Not estimable	13 (1 study)	**low[5]**	No adverse events only withdrawals (3) due to non-improvement in condition

*The basis for the **assumed risk** (e.g. the median control group risk across studies) is provided in footnotes. The **corresponding risk** (and its 95% confidence interval) is based on the assumed risk in the comparison group and the **relative effect** of the intervention (and its 95% CI).
AR: absolute risk; **CI:** confidence interval; **EA:** electroacupuncture; **FIQ:** Fibromyalgia Impact Questionnaire; **MD :** mean difference; **NNT:** number needed to treat; **RR:** risk ratio; **VAS:** visual analogue scale
GRADE Working Group grades of evidence
High quality: Further research is very unlikely to change our confidence in the estimate of effect.
Moderate quality: Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.
Low quality: Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.
Very low quality: We are very uncertain about the estimate.
[1] Itoh 2010, no follow-up.
[2]VAS (0 = no pain, 10 = worse pain ever).
[3]FIQ (20-item questionnaire, higher scores indicate participant is more affected by fibromyalgia).
[4]Intention-to-treat not used, single study with small sample size.
[5]Small sample size.

Summary of findings 2. Acupuncture versus placebo or sham acupuncture for treating fibromyalgia

Acupuncture versus placebo or sham acupuncture for treating fibromyalgia

Patient or population: patients with fibromyalgia
Settings: USA, Switzerland[1]
Intervention: acupuncture versus placebo or sham acupuncture

Outcomes	Illustrative comparative risks* (95% CI)		Relative effect (95% CI)	No of participants (studies)	Quality of the evidence (GRADE)	Comments
	Assumed risk	Corresponding risk				
	Control (sham or placebo)	Acupuncture (EA or MA or combined)				
Pain up to 1 month after treatment (VAS, NRS, SF-MPQ, MPI)[2]	Combined EA and MA **70 points** Scale (0 to 100), lower score means less pain)[2]	Combined EA and MA **0.14 SMD lower** (0.53 lower to 0.25 higher) EA: 57 points SMD -0.63 (-1.02 to -0.23)		286 (6 studies)	⊕⊕⊕⊖ **moderate** [8]	**EA** **AR %:** -13% (-22% to -5%) **RR %:** 22% (35% to 8%) **NNT** 3 (2 to 9) **MA** **AR %** 0.28% (-0.34% to 0.90%) **RR %** 4.00% (-4.86% to 12.86%) **NNT** N/A
Physical function up to 1 month after treatment (SF-36)[3]	MA **28 points** Scale (0 to 100)[4]	MA **22.2 points** (Higher score indicates better physical function) **5.8 MD lower** (10.91 lower to 0.69 lower)		56 (1 studies)	⊕⊕⊕⊖ **moderate** [9]	**AR %** -5.80% (-10.91% to -0.69%) **RR %** -15.21% (-28.61% to -1.81%) **NNT** 4 (2 to 53)
Global well-being: rated by participants up to 1 month after treatment (VAS, FIQ)[4]	Combined EA and MA **4.1 points** Scale (0 to 10)[6]	Combined EA and MA **0.29 SMD higher** (0.44 lower to 1.01 higher) EA		200 (3 studies)	⊕⊕⊕⊖ **moderate** [8]	**EA** **AR %** 11% (4% to 17%) **RR %** 23% (9% to 38% **NNT** 3 (2 to 9)

		SMD 0.65 higher (0.26 to 1.05) (Higher score indicates better well-being)				**MA** **AR %** -8.00% (-17.20% to 1.20%) **RR %** -20.00% (-43.00% to 3.00% **NNT** N/A
Sleep up to 1 month after treatment (VAS, subset FIQ (rest))[5]	Combined EA and MA **3.03 points:** Scale (0 to 10)[8]	Combined EA and MA **0.16 SMD higher** (0.29 lower to 0.61 higher) EA **3.82 points** SMD 0.40 higher (0.01 to 0.79) (Higher score indicates better sleep)		200 (3 studies)	⊕⊕⊕⊖ **moderate** [8]	**EA** **AR %** 8% (0.20% to 16%) **RR %** 9% (0.21% to 17%) **NNT 5** (3 to 206) **MA** **AR %** -5.00% (-14.20% to 4.20%) **RR %** -16.50% (-46.86% to 13.86%) **NNT** N/A
Fatigue up to 1 month after treatment (VAS, MFI, subset FIQ (fatigue))[6]	Combined EA and MA **7.77 points:** Scale (0 to 10)[9]	Combined EA and MA **0.1 SMD lower** (0.81 lower to 0.61 higher) (Lower score indicates less fatigue) EA 6.24 points SMD -0.85 (-1.44 to -0.27)		201 (3 studies)	⊕⊕⊕⊖ **moderate** [8]	**EA** **AR %** -15.30% (-25.92% to -4.86%) **RR %** -20.13% (-34.11% to -6.39% **NNT** 3 (2 to 8) **MA** **AR %** 4.34% (-1.34% to 10.1%) **RR %** 5.59% (-1.72% to 13.11%) **NNT** N/A
Stiffness up to 1 month after treatment (Minutes, subset FIQ (stiffness))[7]	EA **6.6 points:** Scale (0 to 10)[10]	EA **5.7 points** (Lower score indicates less stiffness) **0.45 SMD lower** (0.84 lower to 0.06 lower)		104 (2 studies)	⊕⊕⊕⊖ **moderate** [8]	**AR %** -9.00% (-16.80% to -1.20%) **RR %** -13.24% (-24.71% to -1.76%) **NNT** 5 (3 to 35)

Adverse events Adverse events includes withdrawal and drop-outs that could be clearly identified as due to an adverse event	**Study population**		**RR 0.44** (0.12 to 1.63)	289 (5 studies[1])	⊕⊕⊕⊖ **moderate** [10]	**AR %** 44.00% (12.00% to 163.00%) **RR %** 56.00% (88.00% to 63.00%) 1/6 people who had acupuncture reported adverse events 1/3 people who had fake treatments reported adverse events Overall, such events were minor and lasted less than 1 day
	372 per 1000	**164 per 1000** (45 to 606)				
	Moderate					
	83 per 1000	**37 per 1000** (10 to 135)				

*The basis for the **assumed risk** (e.g. the median control group risk across studies) is provided in footnotes. The **corresponding risk** (and its 95% confidence interval) is based on the assumed risk in the comparison group and the **relative effect** of the intervention (and its 95% CI).

AR: absolute risk; **CI:** confidence interval; **EA:** electro-acupuncture; **FIQ:** Fibromyalgia Impact Questionnaire; **MA:** manual acupuncture; **MD:** mean difference; **MFI:** Multidimensional Fatigue Inventory; **MPI:** Multidimensional Pain Inventory; **NNT:** number needed to treat; **NRS:** numerical pain rating scale; **RR:** risk ratio; **SF-MPQ:** Short-Form McGill Pain Questionnaire; **SMD:** standardised mean difference; **VAS:** visual analogue scale

GRADE Working Group grades of evidence
High quality: Further research is very unlikely to change our confidence in the estimate of effect.
Moderate quality: Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.
Low quality: Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.
Very low quality: We are very uncertain about the estimate.

[1]USA: Assefi 2005; Harris 2005; Harris 2008; Harris 2009; Martin 2006; Switzerland: Deluze 1992. Follow-up only Assefi 2005 (3 and 6 months) and Martin 2006 (1 and 7 months).

[2]Pain: Assefi 2005: VAS (10 cm, 0 = no pain, 10 = worse pain ever), Deluze 1992: VAS (1 to 100 mm, does say which is worse 1 or 100), Harris 2005: NRS (101 points, 0 to 100, 5-point increments, 0 = no pain, 100 = worse pain imaginable), Harris 2008 and Harris 2009 SF-MPQ (subset VAS), Martin 2006; MPI (generalised measure of pain, 61-item questionnaire, higher score means more pain). **At up to 7 months follow-up (** Assefi 2005 **and** Martin 2006 **), pain: 2.4 points lower on a 100-point scale (SMD -0.12; 95% CI -0.52 to 0.28, P = 0.55).**

[3] Harris 2005: SF-36 questionnaire (score 0 to 100 with higher scores indicating better function).

[4]Global well-being: Assefi 2005: VAS (0 to 10, 0 = worse ever, 10=best ever), Deluze 1992: VAS (1 to 10, 10 = best), Martin 2006: FIQ (20-item questionnaire, higher scores indicate participant is more affected by fibromyalgia). **At up to 7 months follow-up (** Assefi 2005 **and** Martin 2006 **), global well-being: 6.7 points lower on a 100-point scale (SMD -0.03; 95% CI -0.87 to 0.81, P = 0.94).**

[5]Sleep: Assefi 2005: VAS (0 to 10, 0 = worse ever,10 = best ever), Deluze 1992: VAS (1 to 10, 10 = best), Martin 2006: subset FIQ (rest). **At up to 7 months follow-up (** Assefi 2005 **and** Martin 2006 **), sleep: 1.8 points lower on a 100-point scale (SMD -0.09; 95% CI -0.44 to 0.26, P = 0.62).**

[6]Fatigue: Assefi 2005: VAS (0 to 10, 0 = worse ever, 10 = best ever, Harris 2005: MFI (calculated using Reliability of Change Index, scores range from 4 to 20 with larger scores indicating more fatigue), Martin 2006: subset FIQ (fatigue). **At up to 7 months follow-up (** Assefi 2005 **and** Martin 2006 **), fatigue: 1 point lower on a 100-point scale (SMD -0.04; 95% CI -0.52 to 0.59, P = 0.90).**

[7]Stiffness: Deluze 1992: morning stiffness (minutes), Martin 2006: subset FIQ (stiffness). **At up to 7 months follow-up (** Martin 2006 **), fatigue: 3 points lower on a 100-point scale (95% CI -1.60 to 1.00, P = 0.65).**

[8] Deluze 1992: intention-to-treat not used.

[9]People who used acupuncture rated their physical function to be 4 points lower (absolute deterioration), small sample size.

[10]Small sample size (however some studies reported no adverse events).

Summary of findings 3. Acupuncture versus medication for treating fibromyalgia

Acupuncture versus medication for treating fibromyalgia

Patient or population: patients with fibromyalgia
Settings: China[1]
Intervention: acupuncture versus medication

Outcomes	Illustrative comparative risks* (95% CI)		Relative effect (95% CI)	No of participants (studies)	Quality of the evidence (GRADE)	Comments
	Assumed risk	**Corresponding risk**				
	Medication (antidepressant)	**Acupuncture**				
Pain up to 1 month after treatment VAS[2]	MA **28.8 points** Scale (0 to 100)	MA **11.5 points** (Lower score indicates less pain) **17.3 MD lower** (24.13 lower to 10.47 lower)		38 (1 study)	⊕⊕⊖⊖ **low[3]**	**AR %** -17.30% (-24.13% to -10.47%) **RR %** -23.32% (-32.52% to -14.11%) **NNT** 2 (lower 1, upper 3)
Physical function						Not reported
Global well-being: rated by participants						Not reported
Sleep						Not reported
Fatigue						Not reported
Stiffness						Not reported
Adverse events	**Study population**		Not estimable	38 (1 study)	⊕⊕⊖⊖ **low[3]**	No details were reported about adverse events, however from the data it would appear there were no drop-outs or withdrawals
	See comment	See comment				
	Moderate					

	0 per 1000	**0 per 1000** (0 to 0)

*The basis for the **assumed risk** (e.g. the median control group risk across studies) is provided in footnotes. The **corresponding risk** (and its 95% confidence interval) is based on the assumed risk in the comparison group and the **relative effect** of the intervention (and its 95% CI).
AR: Absolute risk; **CI:** Confidence interval; **MA:** Manual acupuncture; **MD:** mean difference; **NNT**: number needed to treat; **RR**: risk ratio; **VAS:** visual analogue scale

GRADE Working Group grades of evidence
High quality: Further research is very unlikely to change our confidence in the estimate of effect.
Moderate quality: Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.
Low quality: Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.
Very low quality: We are very uncertain about the estimate.

[1] Guo 2005, paper stated follow-up at 6 months but no data provided.
[2]VAS (0 = no pain, 10 = worse pain ever).
[3]Poorly reported paper (see 'Risk of bias' table).

Summary of findings 4. Acupuncture as an adjunct therapy for treating fibromyalgia

Acupuncture as an adjunct therapy for treating fibromyalgia

Patient or population: patients with fibromyalgia
Settings: Brazil[1]
Intervention: acupuncture as an adjunct therapy

Outcomes	Illustrative comparative risks* (95% CI)		Relative effect (95% CI)	No of participants (studies)	Quality of the evidence (GRADE)	Comments
	Assumed risk	**Corresponding risk**				
	Medication and exercise	**Acupuncture plus medication and exercise**				
Pain up to 1 month after treatment VAS[2]	MA **8 points** Scale (0 to 10)	MA **5 points** (Lower score indicates less pain) **3.0 MD lower** (3.9 lower to 2.1 lower)		58 (1 study)	⊕⊕⊕⊖ **moderate** [4]	**AR %** -30.00% (-39.00% to -21.00%) **RR%** -37.50% (-48.75% to -26.25%) **NNT** 3 (lower 2, upper 10)

Physical function MOS SF-36[3]					Confirmed data not available at time of publication
Global well-being: rated by participants					Not reported
Sleep					Not reported
Fatigue					Not reported
Stiffness					Not reported
Adverse events	**Study population**	**RR 3.57** (0.18 to 71.21)	58 (1 study)	⊕⊕⊕⊖ **moderate** [4]	2 adverse events in acupuncture group (hand oedema at LI4 site)
	0 per 1000 **2 per 1000** (0 to 0)				
	Moderate				
	0 per 1000 **0 per 1000** (0 to 0)				

*The basis for the **assumed risk** (e.g. the median control group risk across studies) is provided in footnotes. The **corresponding risk** (and its 95% confidence interval) is based on the assumed risk in the comparison group and the **relative effect** of the intervention (and its 95% CI).
AR: absolute risk; **CI:** confidence interval; **MA:** manual acupuncture; **NNT**: number needed to treat; **RR**: risk ratio

GRADE Working Group grades of evidence
High quality: Further research is very unlikely to change our confidence in the estimate of effect.
Moderate quality: Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.
Low quality: Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.
Very low quality: We are very uncertain about the estimate.

[1] Targino 2008, follow-up 6, 12 and 24 months. **At up to 7 months follow-up, pain: 5 points lower on a 100-point scale (95% CI -1.49 to 0.4, P = 0.32).**
[2]VAS (10 cm, 0 = no pain, 10 = worst pain experienced).
[3]MOS SF-36 (Portuguese version, 8 multi-item scale measuring quality of life, higher values indicate better life).
[4]No control and single study with small sample size.

Summary of findings 5. Deep invasive acupuncture stimulation versus non-stimulated acupuncture for treating fibromyalgia

Deep invasive acupuncture stimulation versus non-stimulated acupuncture for treating fibromyalgia

Patient or population: patients with fibromyalgia
Settings: USA[1]
Intervention: deep needling with stimulation versus deep needling without stimulation

Outcomes	Illustrative comparative risks* (95% CI)		Relative effect (95% CI)	No of participants (studies)	Quality of the evidence (GRADE)	Comments
	Assumed risk	**Corresponding risk**				
	Control acupuncture: deep needling without stimulation	**Acupuncture: deep needling with stimulation**				
Pain up to 1 month after treatment NRS[2]	MA **53.9 points** Scale (0 to 100)	MA **54.2 points** (Lower score indicates less pain) **0.3 MD higher** (18.34 lower to 18.94 higher)		41 (1 study)	⊕⊕⊕⊖ **moderate** [5]	**AR %** 0.30% (-18.34% to 18.94%) **RR %** 0.57% (-34.55% to 35.68%) **NNT** N/A
Physical function up to 1 month after treatment SF-36[3]	MA **40.2 points** Scale (0 to 100)	MA **34.7 points** (Higher score indicates better physical function) **5.5 MD higher** (11.43 lower to 0.43 higher)		41 (1 study)	⊕⊕⊕⊖ **moderate** [5]	**AR %** 5.50% (-11.43% to 0.43%) **RR %** 14.63% (-30.40% to 1.14%) **NNT** N/A
Global well-being: rated by participants						Not reported
Sleep						Not reported
Fatigue up to 1 month after treatment MFI[4]	MA **14.6 points** Scale (0 to 20)	MA **15.7 points** (Lower score indicates less fatigue) **1.1 MD higher** (1.41 lower to 3.61 higher)		41 (1 study)	⊕⊕⊕⊖ **moderate** [5]	**AR %** 5.50% (-7.05% to 18.05%) **RR %** 6.74% (-8.63% to 22.11%) **NNT** N/A

Stiffness			Not reported
Adverse events			Contained in Table 2

*The basis for the **assumed risk** (e.g. the median control group risk across studies) is provided in footnotes. The **corresponding risk** (and its 95% confidence interval) is based on the assumed risk in the comparison group and the **relative effect** of the intervention (and its 95% CI).
AR: absolute risk; **CI:** confidence interval; **MA:** manual acupuncture; **MD:** mean difference; MFI: Multidimensional Fatigue Inventory; **NNT**: number needed to treat; **NRS:** numerical pain rating scale; **RR**: risk ratio

GRADE Working Group grades of evidence
High quality: Further research is very unlikely to change our confidence in the estimate of effect.
Moderate quality: Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.
Low quality: Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.
Very low quality: We are very uncertain about the estimate.

[1] Harris 2005 compared one type of acupuncture (needles placed in traditional site with manual stimulation) with another type (needles placed in traditional site without stimulation). No follow-up.
[2]NRS rating scale (0 to 100 points, 5-point increments, 0 = no pain, 100 worse pain imaginable).
[3]SF-36 questionnaire (score 0 to 100, with higher scores indicating better function).
[4]MFI (calculated using Reliability of Change Index, scores range from 4 to 20 with larger scores indicating more fatigue).
[5]Single study with small sample size.

BACKGROUND

Fibromyalgia is a musculoskeletal disorder characterised by widespread chronic pain and any number of co-morbidities, such as sleep disturbance, fatigue, stiffness, irritable bowel syndrome, headaches and mood disorders. It affects over 2% of the population and occurs predominantly in females (Wallace 2005). There was, until recently, no pharmacotherapy that effectively addressed all the symptoms associated with fibromyalgia (Lawson 2006). The United States of America's Food and Drug Administration (FDA) has approved 'Lyrica' (pregabalin), 'Savella' (milnacipran HCl) and 'Cymbalta' (duloxetine hydrochloride) (Boomershine 2009) for the treatment of fibromyalgia. In contrast, to date the European Medicines Agency has not approved any pharmacotherapy for the treatment of fibromyalgia (www.fibroaction.org), suggesting that the approved FDA drugs for fibromyalgia are not readily accessible by people globally. Non-drug therapies, such as cognitive behavioural therapy (CBT) and exercise, or a combination of the two approaches, are potentially beneficial for people with fibromyalgia (Nüesch 2012).

With respect to complementary and alternative medicine (CAM), acupuncture, a physical therapy of Traditional Chinese Medicine (TCM) that has been used to treat chronic pain for over two millennia in China, is promising for alleviating the symptoms associated with fibromyalgia (Bergman 2007). Among fibromyalgia sufferers, 91% had used CAM (Pioro-Boisset 1996) and one in five sufferers had sought acupuncture for treatment within two years of diagnosis (Bombardier 1996). In 1998, the National Institutes of Health Consensus Development Conference on Acupuncture stated that acupuncture may be used as an adjunct therapy for fibromyalgia (NIH 1998).

However, no therapy alone has been demonstrated to be universally superior to the others. Consequently, it was considered appropriate that when treating fibromyalgia a multidisciplinary approach be used (Arnold 2006). In the United States of America, approximately one million consumers use acupuncture annually (Burke 2006; Ezzo 2000). Furthermore, acupuncture is a relatively safe intervention (Vincent 2001) when compared with pharmacotherapies. Adverse events associated with acupuncture tend to be mild and short-lasting, such as lethargy and pain at the needling sites (MacPherson 2004).

The plausible mechanism of acupuncture analgesia is its effect on the central nervous system and consequent regulation of neurotransmitters and hormones. Acupuncture stimulates nerve fibres (e.g. A delta afferents), which in turn activate transmission neurons in the dorsal laminae of the spinal cord and further activate three levels of the endogenous pain modulation systems at the spinal cord, midbrain, thalamus and hypothalamus. The activation results in a cascade of pain-modulating endorphins, serotonin and noradrenaline, which contributes to analgesia (Cao 2002; Han 1997; Sims 1997).

Although the pathophysiology of fibromyalgia is not well understood, data suggest that ineffective descending inhibition of the central nervous system may cause an abnormal modulation of sensory inputs (such as mechanoreceptor inputs), resulting in pain (Price 2005). Acupuncture action enhances the function of the endogenous pain inhibition systems and therefore may be beneficial to people with fibromyalgia.

The World Health Organization (WHO) defines real acupuncture, in its broadest sense, as the insertion of needles into the human body surface for therapeutic purposes (WHO 2007). Throughout its history, different treatment styles of acupuncture have been developed in relation to needle size, depth of needling and duration of needle retention as well as *deqi* sensation. *Deqi* is the feeling of soreness, numbness, distension, heaviness or the electric shock sensation that occurs around a correctly placed and manipulated acupuncture needle (WHO 2007).

A number of different styles of acupuncture are presently in use, according to acupuncture point selection and stimulation modes. In clinical practice, the selection of acupuncture points for each patient is based on either a Chinese medicine diagnosis (individualised acupuncture treatment) or symptom alleviation (formula acupuncture treatment). Sometimes trigger points are also selected for needling and this may be described as dry needling. There is also micro-system acupuncture where needles are mainly inserted into defined points on an anatomical part of the body such as the head (scalp acupuncture), the ear (auricular acupuncture) or the hand (hand acupuncture). Needles can be deeply inserted into soft tissue and manipulated to elicit *deqi* (also known as traditional Chinese acupuncture) or superficially inserted into the skin without eliciting *deqi* (which may be described as Japanese acupuncture/meridian therapy).

Apart from, and in addition to, needles, acupuncture points or other points mentioned above can be stimulated using heat (such as moxibustion), with electrical current (known as electro-acupuncture), using mechanical pressure (acupressure) or using laser (laser acupuncture). Of all the forms of stimulation of acupuncture points, needling involving skin penetration (manual acupuncture) is the most commonly used method.

In 2007, a systematic review of acupuncture for fibromyalgia concluded that "acupuncture could not be recommended for fibromyalgia" (Mayhew 2007). However, it appears that this review neither searched for nor included studies from Chinese databases. In addition, new studies have been published. Therefore, there is a need to perform a thorough review to allow an up-to-date assessment of all available studies to determine the potential role of acupuncture in the management of fibromyalgia.

OBJECTIVES

The present review aims to determine whether real acupuncture is more beneficial in terms of pain reduction, function and well-being improvement than placebo and other treatments and is safe in people with fibromyalgia. We examined the following comparisons:

1. Acupuncture versus no acupuncture (e.g. wait list)
2. Acupuncture versus placebo or sham acupuncture
3. Acupuncture versus standard/usual care (e.g. cognitive behavioural therapy (CBT) and/or exercise and/or pharmacotherapy)
4. Acupuncture as an adjunct therapy to standard/usual care (evaluating additional effect)
5. A particular style of acupuncture versus another (e.g. deep needling with stimulation versus deep needling without stimulation)

METHODS

Criteria for considering studies for this review

Types of studies

We considered randomised and quasi-randomised controlled clinical studies of acupuncture for treating patients with fibromyalgia. Quasi-randomised studies are those that do not strictly adhere to methods of true randomisation, e.g. location by the order of admission or date of birth. Inclusion of studies was not restricted according to language, type of publication or presence of blinding. We excluded studies from which we could not extract reported clinical outcomes or data for analyses.

Types of participants

Criteria for inclusion were participants of either gender, aged 18 and over, with a diagnosis of fibromyalgia according to the American College of Rheumatology (ACR) classification criteria for fibromyalgia (Wolfe 1990).

Types of interventions

Types of intervention were restricted to acupuncture that breaks the skin for therapeutic benefit (WHO 2002). Studies comparing different styles of acupuncture were also included. In addition, studies in which acupuncture was an adjunct therapy to other therapies (e.g. herbs, cupping, physiotherapy, exercise) were included, provided the control groups also received these therapies. Studies in which acupuncture points were stimulated with methods that did not break the skin, such as transcutaneous electrical nerve stimulation (TENS), infrared light, laser or digital pressure, were excluded. Acupuncture points refer to those points as defined in the Standard Acupuncture Nomenclature by the World Health Organization (WHO) (WHO 2002). Studies that used *ashi* acupuncture points (i.e. tender points) or trigger points were also to be included.

The control interventions included sham/fake/placebo acupuncture, other types of placebo control, non-acupuncture treatment, different styles of acupuncture or other treatment. An example of non-acupuncture treatment is a wait list. We considered standard care to be pharmacotherapy and/or exercise and/or CBT. When selecting studies that used sham/placebo acupuncture, we chose controls that did not intend to be an effective intervention, for example, needling on irrelevant acupuncture points, superficial needling or both. Other sham controls could have a disconnected electro-acupuncture stimulator, an inactive laser, mock TENS, infrared light or digital pressure. If there were sufficient studies, we planned to examine the differences between the various types of sham acupuncture (e.g. insertion verses non-insertion, deep needle verses shallow needle, on the acupuncture point versus off the acupuncture point). We excluded studies that did not provide adequate details of the control intervention.

Types of outcome measures

Included studies must have reported one or more of the following main clinical outcome measures related to pain, function and quality of life.

Main outcomes

1. Pain (e.g. visual analogue scale (VAS), numerical pain rating scale (NRS), McGill Pain Questionnaire (SF-MPQ), Multidimensional Pain Inventory (MPI) or Regional Pain Scale score)
2. Physical function (e.g. 36-Item Short-Form Health Survey (SF-36, Physical) or Health Assessment Questionnaire (HAQ))
3. Global well-being as rated by participants (e.g. Fibromyalgia Impact Questionnaire (FIQ), VAS rated by participants)
4. Sleep (e.g. VAS of intensity, numerical sleep scale 1 to 10)
5. Fatigue (e.g. VAS, Multidimensional Fatigue Inventory (MFI))
6. Morning stiffness (e.g. numerical scale)
7. Adverse events: proportion of participants who experienced an adverse event and proportion who withdrew due to adverse events

Provided the studies had main outcomes, we also considered any of the following minor outcomes.

Minor outcomes

1. Tenderness (e.g. number of tender points or pain threshold of tender points as measured with a dolorimeter)
2. Mental well-being (e.g. SF-36 (mental), Hamilton Depression Rating Scale (HAMD))
3. Analgesic use (e.g. diary)
4. Changes in fibromyalgia symptoms (e.g. observer-rated change in fibromyalgia symptoms (including that rated by physicians))
5. Overall well-being rated by the study care givers

In the 'Summary of findings' table, we included the main outcomes of pain, physical function, global well-being, sleep, fatigue, stiffness and total adverse events (Arnold 2011).

Search methods for identification of studies

We initially searched the following databases from their inception to April 2008 as per protocol. We updated the search in May 2010 and January 2012. Search terms used included 'fibromyalgia' and 'acupuncture' and their variations (Figure 1).

Figure 1. A flow chart of study selection. ('English' refers to English databases and 'Chinese' refers to Chinese databases).

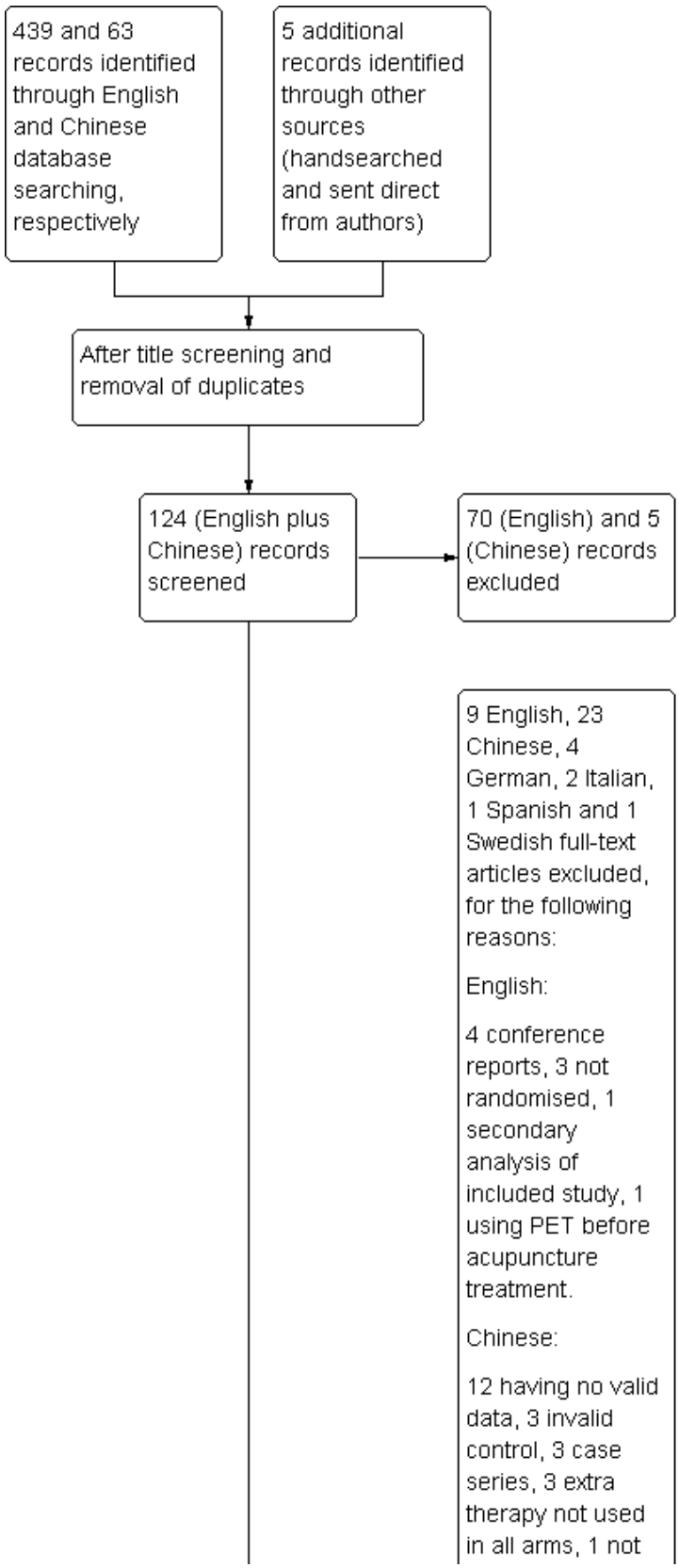
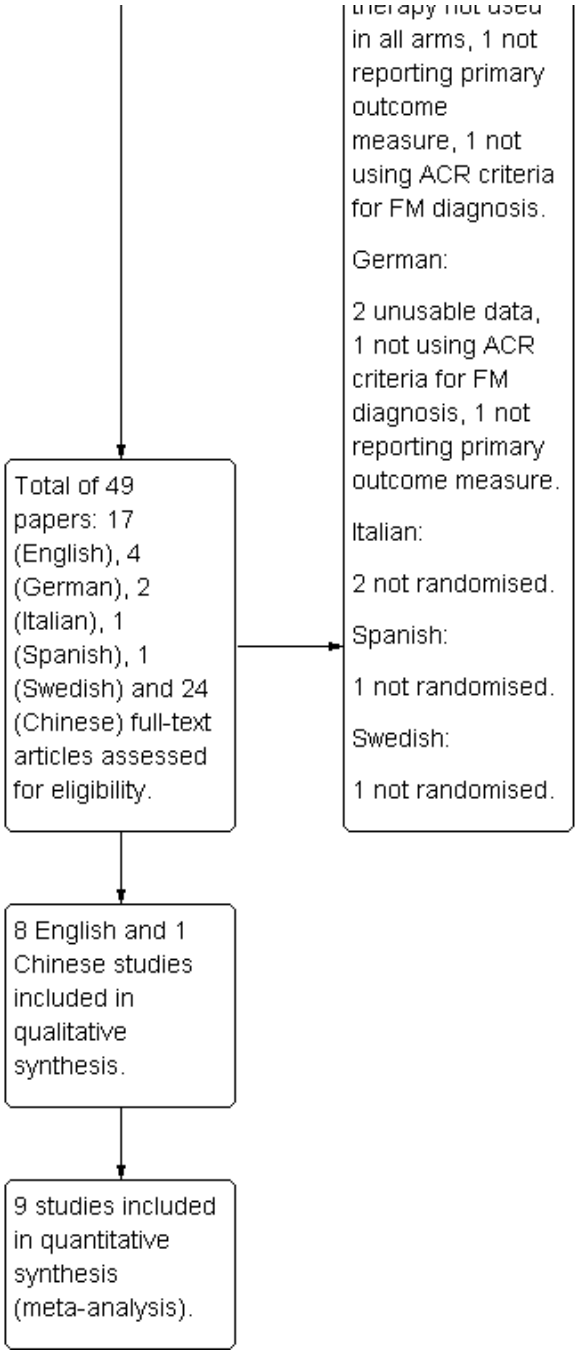


Figure 1. (Continued)



- Cochrane Central Register of Controlled studies (CENTRAL), via *The Cochrane Library*, Issue 1, 2012 (www.thecochranelibrary.org) (Appendix 1)
- MEDLINE via PubMed, CAM PubMed and PubMed Central (http://www.ncbi.nlm.nih.gov/pubmed/) (Appendix 2)
- EMBASE (http://ovidsp.tx.ovid.com/) (Appendix 3)
- CINAHL (http://www.ebscohost.com/) (Appendix 4)
- Chinese databases: Chongqing Weipu (VIP) (http://lib.cqvip.com/) (Appendix 5) and Wanfang Database (http://www.wanfangdata.com.cn/) (Appendix 6)
- Unpublished databases: National Research Register via the Department of Health, UK (www.dh.gov.uk) (Appendix 7); HSRProj via the National Library of Medicine, USA (http://wwwcf.nlm.nih.gov) (Appendix 8)
- Current Contents (http://apps.webofknowledge.com.ezproxy.lib.rmit.edu.au/) (Appendix 9)

Additional studies

We handsearched the bibliographies of review articles, excluded studies and textbooks on acupuncture, pain and fibromyalgia for

additional studies. We contacted authors of published studies in an attempt to locate any unpublished studies.

Data collection and analysis

Selection of studies

One author (JD) searched the English language databases, while another author (ZZ) searched the Chinese language databases. These two authors independently examined the abstracts of the potential studies and obtained the full-text articles for consideration based on our pre-defined inclusion and exclusion criteria. We checked all references in the retrieved full-text English, Chinese and foreign language studies. Three potential papers were translated by the Cochrane Centres in Germany (one) and Italy (two). Three native speakers of Russian, Dutch and Spanish examined one paper each in these languages for potential studies. Four authors (JD, SS, ZZ, CX) with two in each group examined the English and Chinese studies, respectively, for inclusion/exclusion. Two authors (JD and ZZ) assessed the Harris 2008, Itoh 2010 and Targino 2008 papers. There were no disagreements between each pair of review authors.

Data extraction

Two author pairs (English: JD, SS and Chinese: ZZ, JSS) independently extracted data for each included study using our standard data extraction sheet. JD and ZZ extracted the data from Harris 2008, Itoh 2010 and Targino 2008. Data extracted included study characteristics, items related to the 'Risk of bias' tool and adverse events for each arm of the studies. We also extracted effect measures from each trial, including mean and standard deviation for continuous outcomes at or within one month of the end of the treatment; and number of events and number of participants in each group for dichotomous outcomes at the end of the treatment.

Assessment of risk of bias in included studies

Two review author groups, with two authors in each (JD, SS and ZZ, JSS), individually assessed the methodological quality of the English and Chinese studies, respectively, and incorporated them into the 'Risk of bias' tables. Items included in the tables are adequate sequence generation, allocation concealment (selection bias), blinding of the participants (performance bias), blinding of the assessor (detection bias), incomplete outcome data and its impact on the effect of estimate (attrition bias), and selective reporting (reporting bias). Using the extracted information, two authors (JD, ZZ) assessed whether they met the guidelines by selecting one of three choices: 'Yes', 'No' or 'Unclear' and reported the details of each decision in the allocated section of the table.

Assessment of the quality of the acupuncture treatments

To assess the quality of the acupuncture treatments, the two review author groups, all experienced clinical acupuncturists (minimum 10 years of experience each), used three instruments. We used the Standards for Reporting Interventions in Controlled Trials of Acupuncture (STRICTA) (MacPherson 2002) to extract the details of acupuncture intervention (Appendix 10), including acupuncture rationale, needling details, treatment regimen, co-interventions, practitioner background and control interventions, which are not addressed by other assessment tools. The purpose of STRICTA is to improve the reporting of interventions of controlled studies in acupuncture. This allows replication of the acupuncture treatment in other studies and clinical practice. As STRICTA does not offer a rating or scale to make a critical evaluation of the reporting, we further developed two rating systems to assess the adequacy of acupuncture treatment and confidence in the acupuncture diagnosis and treatment based on STRICTA data. Similar approaches have been used in other systematic reviews (Linde 2009; Scott 2006).

Adequacy of acupuncture treatment protocol

The rationale for examining the adequacy of treatment was to ensure that the study treatment protocol was comparable to routine clinical practice and the style of treatment was consistent with the techniques applied. For instance, a study claiming to be based on Chinese medicine but not eliciting *deqi* or only using a single needle would be considered inappropriate. Likewise, a treatment using appropriate Chinese medicine point selection but with only a single treatment would also be viewed as inadequate.

Assessment is based the on the following parts of the STRICTA table (Appendix 10).

- Acupuncture style
- Rationale for treatment/points used
- Literature sources
- Uni/bilateral
- Number of needles inserted
- Depth of insertion
- Response elicited
- Type of needle stimulation (electro/manual with or without tonification/dispersion etc.)
- Needle retention time
- Number of treatment sessions
- Frequency of treatments

From the list above, the review authors were required to judge if the acupuncture treatment performed was suitable for the style of acupuncture stated in the rationale for treatment. The experienced acupuncturists (JD, ZZ, JSS, SS) on the team rated the studies as low, medium or high according to whether the acupuncture treatment protocol was adequate. If there was insufficient information, we marked the study as 'insufficient information'.

Confidence in the diagnosis and treatment delivery

The determination of confidence in the administration of the acupuncture treatments was based on whether the person making the diagnosis, delivering the treatment or both was trained to the industry standard in that style. For example, L.Ac (licensed acupuncturist) would indicate meeting the USA standard. We used information about practitioners' training and practice background from STRICTA (Appendix 10) and information about the trial procedure to assess the level of confidence. For instance, it would be inappropriate to have an acupuncturist trained in Japanese/meridian style, i.e. shallow needling on acupuncture points, to provide Chinese acupuncture. Equally, we did not consider it appropriate that acupuncturists who had no Chinese medicine differential diagnosis training to deliver Chinese medicine diagnosis and treatment, unless a well-explained protocol was in place or pre-trial training was given and competence of the trial acupuncturists was assessed prior to the commencement of the

study. The review authors rated their confidence at three levels: low, medium or high.

Measures of treatment effect

We analysed the data according to the Cochrane guidelines. To examine the immediate effect, we used completed data at up to one month after the end of the treatment. This method has been used in other reviews (Vickers 2012). To examine the long-term effect, we extracted data collected up to seven months after the end of the treatment. We plotted outcomes from each study as point estimates with corresponding 95% confidence intervals (CI) expressed as mean differences (MD) for continuous outcomes using the same scale, such as a 0 to 100 VAS for the measurement of pain or standardised mean differences (SMD) for continuous outcomes that used different scales, such as VAS and NRS for pain. We reported the number of adverse events and the number of drop-outs due to adverse events using risk ratios (RR). We also analysed data at one and up to seven months after treatment.

When ranges of data were presented, we calculated the standard deviations (SD) as advised and checked by the statistician from the Cochrane Musculoskeletal Group (CMSG) according to the Cochrane guidelines. With studies using more than one control arm we combined them as per the Cochrane guidelines (Higgins 2011).

Dealing with missing data

We contacted the authors of the included/excluded articles to obtain further information. We received responses to queries from the authors of Assefi 2005 (via the last author of the article); Deluze 1992; Harris 2005; Harris 2008; Harris 2009; Itoh 2010; Martin 2006; Sprott 1998; Targino 2008.

Assessment of reporting biases and small sample biases

For studies published after 1 July 2005, we screened the Clinical Trial Register via the International Clinical Trials Registry Platform of the World Health Organization (http://www.who.int/ictrp/en/) and compared the outcome measures described in the registry with those reported in the publications to assess whether selective reporting of outcomes was present (outcome reporting bias).

As planned, we compared the fixed-effect estimate against the random-effects model to assess the possible presence of small sample bias in the published literature given that the random-effects estimate of the intervention is more beneficial than the fixed-effect estimate in the presence of small sample bias (Higgins 2011). We found no difference between the two analyses in any outcome measures except for pain under the comparison of acupuncture versus sham acupuncture. The result of the random-effects model was more conservative than the fixed-effect model. Thus, we reported only the results from random-effects model.

If there were sufficient studies (> 10 studies with the same outcome), we planned to assess for publication bias using a funnel plot (Sutton 2000). This was not conducted due to an insufficient number of trials.

Data synthesis

As recommended by the Cochrane Musculoskeletal Group editor, we used the random-effects model as the default for data synthesis.

Subgroup analyses and assessment of heterogeneity

When there were sufficient appropriate data, we planned subgroup analyses to assess the effect of different types of acupuncture: 1) manual acupuncture versus electro-acupuncture; 2) shallow needling versus deep needling; 3) different forms of sham/placebo acupuncture.

We used the I^2 statistic to describe the percentage variability of effect estimates that were due to heterogeneity. If there was substantial statistical heterogeneity (I^2 value of 50% or more) (Higgins 2011), we examined the characteristics of individual studies to determine possible causes.

Sensitivity analyses

We also planned to conduct sensitivity analyses to examine whether aspects of methodological quality influence the effect size. For example, did inadequate or unclear concealment of allocation or failure to blind outcome assessors change the overall effect estimate of our meta-analysis for pain?

'Summary of findings' tables

We presented the main outcomes (pain, physical function, global well-being (rated by participants), sleep, fatigue, stiffness and adverse events (Arnold 2011)) in 'Summary of findings' tables. The tables include an overall grading of the evidence using the GRADE approach of high, moderate, low and very low quality:

- High quality: further research is very unlikely to change our confidence in the estimate of effect.
- Moderate quality: further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.
- Low quality: further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.
- Very low quality: we are very uncertain about the estimate.

The 'Summary of findings' tables also contain the available data on the main outcomes as the calculations for statistically significant outcomes, and the number needed to treat (NNT) as recommended by The Cochrane Collaboration (Higgins 2011).

For continuous outcomes, we calculated the NNT using the Wells calculator software, available from the Cochrane Musculoskeletal Group editorial office (www.cochranemsk.org), which requires a minimal clinically important difference for input into the calculator. For pain we used a 1.5-point difference out of a 0 to 10 scale or 15 out of 0 to 100 scale as a minimal clinically important change. For global well-being, we used 14 out of 100 as a minimal clinically important change as recommended by Bennett 2009 for dealing with FIQ data. For sleep, fatigue, stiffness (Martin 2006) and physical function (Harris 2005), we used 13 out of 100 or 1.3 out of 10 as a minimal clinically important change (Bennett 2009). We calculated absolute change (benefit) from the mean difference or standard mean difference and expressed this as a per cent and in the original units, and calculated relative difference in the change from baseline as the absolute benefit divided by the baseline mean of the control group.

RESULTS

Description of studies

Detailed data are summarised in the tables 'Characteristics of included studies' and 'Characteristics of excluded studies'.

Total studies located for this review

We conducted our initial search in 2008, updated it in May 2010 and then updated it again in January 2012. The search period ranged from the inception of the databases to the end of December 2011. The study selection process is illustrated in Figure 1. The search resulted in 439 studies from the English databases and 63 from Chinese databases. After removing duplicates and irrelevant papers, we identified 49 acupuncture trials for fibromyalgia, including 17 papers in English, 24 in Chinese, four in German, two in Italian, one in Spanish and one in Swedish.

Studies excluded from the review

We excluded 40 studies for the following reasons:

- Twelve reported number of responders only, without providing any data on the main outcome measures (Guan 2005; Guo 2003; Guo 2005a; Li 2005a; Li 2005; Wang 2002; Wang 2004; Wei 2006; Wu 2003; Yao 2006; Zhang 2001; Zhou 2003).
- Six were conference reports with no useable data (Feldman 2001; Guevara 2007; Harris 2007a; Harris 2007b; Sprott 1995 (translated by the German Cochrane Centre and the author asked us to use his 1998 version); Uhlemann 2001).
- Three had an invalid control (Jiang 2010; Li 2006; Li 2010).
- Three were case series (Chen 2009; Dai 2009; Sun 2008).
- Three had an extra therapy that was not used in the other arm of the trial (Cao 2003; Gong 2010; Gou 2010).
- Four were not randomised; one Spanish (Collazo Chao 2010); one Swedish (Sandberg 1999); two Italian studies stated randomisation in the English abstracts, however the Italian Cochrane Centre, who translated the papers, advised that they were case series (Cassisi 1994; Cassisi 1995).
- Two did not meet the ACR criteria for fibromyalgia: (Lautenschlager 1989; Lui 2002).
- Two had insufficient data (Sprott 1998 (could not obtain or confirm the data from the author); Targino 2002).
- Two did not report any of our main outcome measures (Li 2008; Sprott 2000).
- One measured blood flow in the muscles upon needling, but did not assess the clinical outcomes (Sandberg 2004).
- One was a secondary analysis of an included trial, the Harris 2005 study (Harris 2006).
- One examined brain images using position emission tomography of participants prior to the acupuncture treatment (Harris 2007).

Studies included in the review

Nine RCTs and one quasi-RCT were included. Five studies were conducted in the United States of America (Assefi 2005 n = 96; Harris 2005 n = 56; Harris 2008 n = 10; Harris 2009 n = 20; Martin 2006 n = 49), one in Switzerland (Deluze 1992 n = 55), one in Brazil (Targino 2008 n = 58), one in Japan (Itoh 2010 n = 13) and one quasi-RCT in China (Guo 2005 n = 38). All studies were published in English except for one published in Chinese.

Participants

In total 395 participants were involved. The authors of the selected papers explained their inclusion and exclusion criteria well except for Guo 2005, which only reported inclusion without exclusion criteria. All studies used acupuncture-naive participants except for Targino 2008, while Guo 2005 did not report this. Targino 2008 admitted participants into their study if they had not received acupuncture in the last 12 months. All studies reported using ACR fibromyalgia criteria for the selection of participants. However, confirmation of the diagnosis before commencement of the studies was reported in only four studies (Assefi 2005; Itoh 2010; Martin 2006; Targino 2008). Assefi 2005 used a researcher trained in tender point examination, Itoh 2010 obtained participants direct from fibromyalgia specialists at hospitals, Martin 2006 used a rheumatologist and Targino 2008 used a physician. The other five studies did not report whether or not they performed a confirmation of diagnosis (Deluze 1992; Guo 2005; Harris 2005; Harris 2008; Harris 2009).

Sample size

All included studies clearly explained their sample size calculation except for Guo 2005, Harris 2008, Harris 2009 and Itoh 2010. The sample size ranged from four participants to 36 per arm.

Main outcomes

Main outcome measurement tools varied. Five studies (Assefi 2005; Deluze 1992; Guo 2005; Itoh 2010; Targino 2008) used a VAS for measuring pain. Other measurement tools for pain included Regional Pain Score (Deluze 1992), Numeric Rating Scale (Harris 2005), Multidisciplinary Pain Inventory (Martin 2006) and Short Form of the McGill Pain Questionnaire (Harris 2008; Harris 2009). Three studies measured quality of life (SF-36). Assefi 2005 used SF-36 including the Physical and Mental component, Harris 2005 the SF-36 Physical component, and Targino 2008 reported all eight domains of SF-36. Two studies measured function using the FIQ (Itoh 2010; Martin 2006), which is labelled as global well-being in the current review. Five studies did not include a follow-up phase after the end of the treatment (Deluze 1992; Harris 2005; Harris 2008; Harris 2009; Itoh 2010). The remaining four had follow-ups at different time points with Assefi 2005 at the 3rd and 6th months after the end of the treatment; Guo 2005 at the 6th month; Martin 2006 at the 1st and 7th months; and Targino 2008 at the 3rd, 6th, 12th and 24th months.

Withdrawal/drop-outs

All studies reported withdrawal, drop-outs or both except for Guo 2005, however the reported data indicated there were no drop-outs. The most common reason for withdrawal or drop-out was time constraint, followed by worsening of fibromyalgia symptoms and scheduling conflicts (e.g. appointments). The serious events for discontinuing participation were: one experienced heart attack from the acupuncture group (Assefi 2005); three hospitalisations with one from the acupuncture group and two from the control group; one ankle oedema from the acupuncture group (Deluze 1992), which was the only case that authors reported to be directly related to the acupuncture treatment (ankle oedema). The heart attack and the hospitalisation cases were not explained and

connections with interventions were not established. The low drop-out rate may suggest the treatments were well tolerated by the participants.

Assessment of the quality of the acupuncture treatments

STRICTA

Reporting of the acupuncture treatments was generally adequate with the exception of Guo 2005 and Itoh 2010, being the poorest. Upon our request, some authors provided missing details via e-mails, however based on the published papers as they were, it would have been impossible to reproduce any of the studies accurately (Appendix 10).

Adequacy of acupuncture treatment protocol

Reporting of the rationale of the acupuncture treatment was insufficient, making it difficult for us to give a rating. Considering all 11 criteria, we rated the studies as 'medium' for all studies except for Guo 2005 and Itoh 2010, which we noted as 'insufficient data'. Six studies (Deluze 1992; Guo 2005; Harris 2005; Harris 2009; Itoh 2010; Martin 2006) actually stated the acupuncture style, while the rest did not report the style. Based on how they reported the acupuncture treatment, we inferred that it was 'formula acupuncture' (symptom alleviation), using a set of fixed acupuncture points.

None of the studies stated whether they had made a diagnosis according to Chinese medicine, except for Deluze 1992, but there was insufficient information to confirm this. Deluze 1992 stated that they individualised treatment and provided references to support their decision. However, the authors failed to report their Chinese medicine diagnosis.

The justification of acupuncture point selection deserved some attention. Only one study provided journal references for their decision on point selection and choice of electro-acupuncture (Deluze 1992). This study reported, however, only two mandatory acupuncture points without detailing the other eight optional points. Assefi 2005 commented that no gold standard existed for acupuncture point selection in the treatment of fibromyalgia, with the authors consulting three experienced acupuncturists in treating fibromyalgia for their point selection. Guo 2005 did not state what acupuncture points were used, instead naming the channels/meridians they used. They considered '*Back Shu*' points along the Bladder meridian important to strengthen Liver, Spleen and Kidney when treating *Bi*-Syndrome, a Chinese medicine term for a series of rheumatic conditions, including fibromyalgia. Harris 2005 chose acupuncture points based on their "ability to relieve fibromyalgia symptoms in CM", however this was referenced to a textbook that does not specify Chinese medicine treatments for fibromyalgia. Harris 2008 and Harris 2009 referenced their 2005 trial for their acupuncture point selection. Itoh 2010 did not explain. Martin 2006 stated they used "strong regulatory points that commonly recur in acupuncture literature", yet provided neither reference nor stated the acupuncture points used on the back (published a small diagram of areas used). They also stated that their acupuncture point selection might not be optimal as judged by others, but did not provide the reason. Targino 2008 used "classical acupuncture points" and they referenced an acupuncture point location book that does not include fibromyalgia. The most commonly used point in all included studies was *He Gu* (LI4), followed by *Zu San Li* (ST36).

With the reporting of unilateral/bilateral needling details, Assefi 2005, Deluze 1992, Guo 2005 and Itoh 2010 did not state which side they inserted the needles on, while Martin 2006, Harris 2005 and Harris 2009 provided diagrams. Harris 2008 based the treatment on their 2005 trial. Except for Deluze 1992, Guo 2005 and Itoh 2010 the number of needles used was clearly stated. Reporting the depth of needle insertion was clear in all studies except for Guo 2005, which we thought was subcutaneous because the needling technique was "point to point threading" along the back meridian/channels. Reporting of elicitation of *deqi* was clear except for Assefi 2005, Guo 2005 and Itoh 2010; two stated "stimulation" without mentioning *deqi* (Assefi 2005; Itoh 2010) and the other did not report this (Guo 2005). The description of the type of needle stimulation/manipulation (e.g. lifting/thrusting/even etc.) was clear in only three studies (Harris 2005; Harris 2009; Itoh 2010). With the electro-acupuncture studies (Deluze 1992; Itoh 2010; Martin 2006) both reported Hz but not where the red/black clips went or what type of stimulation setting was used, such as 'continuous'. Needle gauge/length/manufacturer or material varied greatly and were not well reported by some.

Needle retention time ranged from 20 to 30 minutes. Four studies treated the participants for 30 minutes (Assefi 2005; Guo 2005; Harris 2005; Itoh 2010), two for 25 minutes (Harris 2008; Harris 2009) and two for 20 minutes (Martin 2006; Targino 2008). One did not report the needling duration (Deluze 1992). The median duration of acupuncture treatment sessions was four weeks (range 3 to 13). Two had six sessions (Deluze 1992; Martin 2006), with the remainder, nine (Harris 2008; Harris 2009), 10 (Itoh 2010), 18 (Harris 2005), 20 (Targino 2008), 24 (Assefi 2005) and 28 sessions (Guo 2005). Itoh 2010 was a cross-over study and we used data before cross-over for analysis; that is after five sessions of treatment. Frequency of treatments was similar in most studies, with twice weekly being the commonest (Assefi 2005; Deluze 1992; Martin 2006; Targino 2008). Two trials (Harris 2008; Harris 2009) had nine sessions over four weeks, another (Harris 2005) gave 18 sessions over 13 weeks, while one (Itoh 2010) delivered weekly and the remainder (Guo 2005) daily treatment.

Confidence in the treatment delivery

We rated our confidence that acupuncture treatments were appropriately delivered by skilled practitioners as 'high' for Assefi 2005 and Harris 2005 and 'medium' for Targino 2008. The remaining studies (Deluze 1992; Guo 2005; Harris 2008; Harris 2009; Itoh 2010; Martin 2006) we noted as 'insufficient data'.

Adverse events

Reporting of adverse events was inconsistent. Only two studies provided details of the number of events (Assefi 2005; Targino 2008). With the remaining studies, three did not report any (Harris 2005; Harris 2008; Harris 2009), which the author confirmed as nil. Two (Deluze 1992; Itoh 2010) cited them as withdrawals, one (Martin 2006) discussed them in the results without labelling them as adverse events and one (Guo 2005) did not report any.

None of the studies reported serious adverse events. The worst events that could directly be attributed to an acupuncture treatment were oedema of the left hand and ankle, despite a lack of evidence of a causal relationship (Targino 2008). Two cases of vasovagal symptoms reported by Martin 2006 were likely due to the posture of the participants. The author did not explain which treatment group the cases were in. In that study, all participants

received acupuncture treatment seated without a back support for 20 minutes, which is not a common practice (participants are mostly in a prone or supine position), however it allowed the participants to be blinded. This type of adverse event could be prevented or reduced with correct posture as suggested by the author.

Subgroup analyses

We undertook subgroup analyses within the comparison of acupuncture versus placebo/sham acupuncture to compare electro- and manual acupuncture for the outcome of pain, fatigue, sleep and global well-being (rated by participants) as data were available for those outcome measures. We also undertook a subgroup analyses of studies using sham acupuncture without breaking the skin (Assefi 2005; Harris 2008; Harris 2009; Martin 2006) versus studies using breaking-skin sham interventions (Assefi 2005; Deluze 1992; Harris 2005). One arm of the control (simulating) in Assefi 2005 and the sham controls in Harris 2008 and Harris 2009 used a tooth pick in an acupuncture guide tube, which has been shown in other studies of back pain to be indistinguishable (Sherman 2002). Martin 2006 indented the skin with a blunt probe and placed over the area a small circular plaster rigged with an acupuncture needle that stuck out; they stated that preliminary trials showed volunteers could not tell the difference.

Publication bias

We did not perform the planned publication bias funnel plot analysis due to an insufficient number of selected studies (Sutton 2000).

Sensitivity analyses

We could not conduct planned sensitivity analyses due to a lack of trials with and without adequate concealment of allocation; or with and without blinded outcome assessor under one comparison. For instance, under the comparison of real and sham acupuncture, all six studies were at low risk of selection bias with adequate concealment of treatment allocation, using no treatment as the control, and at low risk of detection bias with outcome assessors being blinded (Assefi 2005; Deluze 1992; Harris 2005; Harris 2008; Harris 2009; Itoh 2010; Martin 2006). Two studies were at higher risk of selection bias with unclear or inadequate allocation concealment and had a high risk of detection bias with inadequate or unclear blinding of outcome assessor (Guo 2005; Targino 2008). They were, however, under different comparison categories and contained only one study in each. Itoh 2010 had a moderate risk of bias as a non-acupuncture treatment control was used.

Risk of bias in included studies

All studies were described as RCTs. Adequate sequence generation and allocation concealment were well described and adequate in all included studies except for Guo 2005, which used order of admission for randomisation (quasi-randomisation) and Martin 2006, which did not say how the sequence was generated. All studies used acupuncture-naive participants except for Guo 2005 (who did not report this) and Targino 2008 (patients had not had acupuncture in the last 12 months). Four studies tested for assessment of masking/blinding (Assefi 2005; Harris 2005; Harris 2009; Martin 2006) and found no difference between groups. Five studies blindfolded their participants (Assefi 2005; Harris 2005; Harris 2008; Harris 2009), while Martin 2006 blocked the vision of the participants. All used blinded assessors except for Guo 2005, which did not report this. All studies showed no missing data except for Deluze 1992 and Itoh 2010, which did not include participants who dropped out from the study in their data analysis, while Guo 2005 did not report this specifically. All reported numbers lost to follow-up except for Guo 2005, which did not report this but no participant was missing from the reported data. In terms of selective reporting, only Assefi 2005, Harris 2005 and Targino 2008 were registered with the International Clinical Trials Registry Platform of the World Health Organization and we found that the outcome measures reported were same as those included in the published protocols. Among the remainder, one did not know about it (Martin 2006), one did not need to report it as it was before the establishment of the Registry (Deluze 1992), whereas the others did not list this (Guo 2005; Harris 2008; Harris 2009; Itoh 2010) (Figure 2; Figure 3).

Figure 2. Methodological quality summary: review authors' judgements about each methodological quality item for each included study.

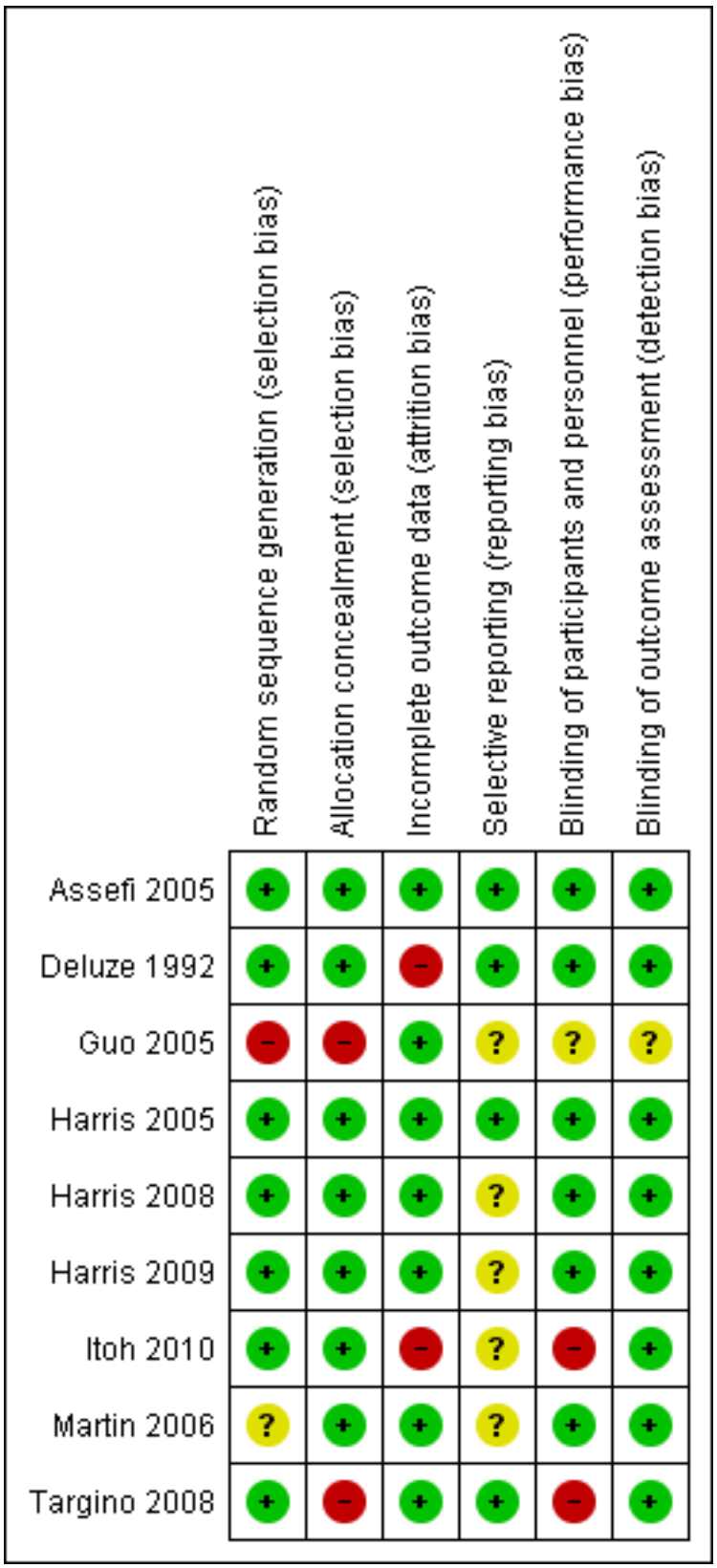
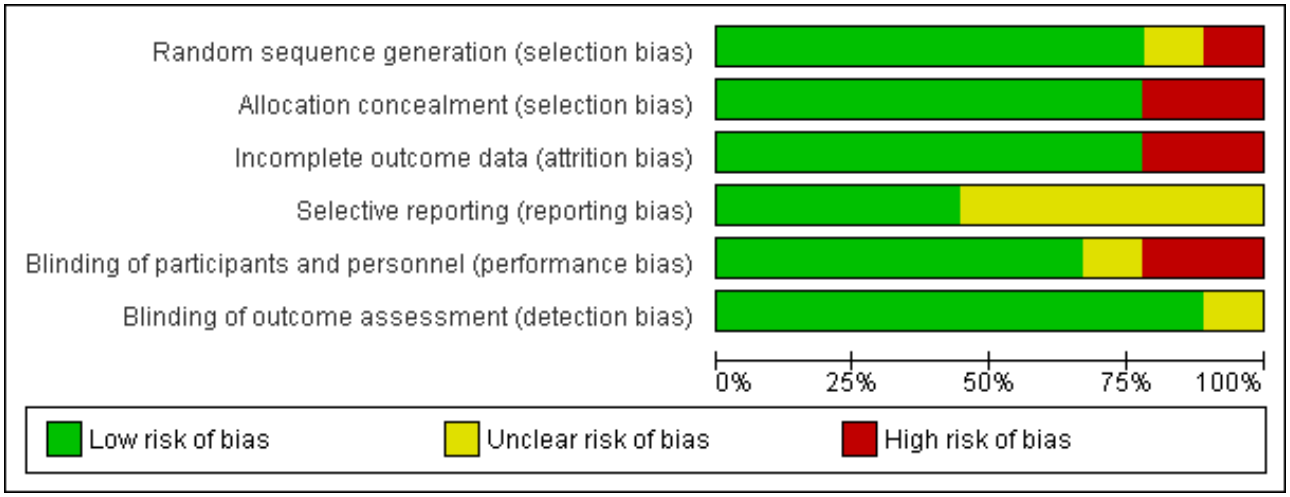


Figure 3. Methodological quality graph: review authors' judgements about each methodological quality item presented as percentages across all included studies.



Effects of interventions

See: **Summary of findings for the main comparison** Acupuncture versus non-acupuncture for treating fibromyalgia; **Summary of findings 2** Acupuncture versus placebo or sham acupuncture for treating fibromyalgia; **Summary of findings 3** Acupuncture versus medication for treating fibromyalgia; **Summary of findings 4** Acupuncture as an adjunct therapy for treating fibromyalgia; **Summary of findings 5** Deep invasive acupuncture stimulation versus non-stimulated acupuncture for treating fibromyalgia

1) Real acupuncture versus non-acupuncture treatment

One study in this category (Itoh 2010) included 13 participants and compared electro-acupuncture plus trigger point acupuncture with no acupuncture treatment. This was a cross-over study, and we used data before cross-over for analysis, that is after five sessions of treatment at the end of week five of a 10-week treatment programme.

Main outcome measure 1: Pain

Pain severity was measured using a VAS (100 mm). It showed a statistically significant reduction in pain for those treated with real acupuncture compared with no acupuncture at the end of treatment (mean difference (MD) -22.40 points on a 100-point scale; 95% confidence interval (CI) -40.98 to -3.82, P = 0.02), favouring acupuncture (Analysis 1.1).

Main outcome measure 2: Global well-being; rated by participant

Global well-being was measured using the Fibromyalgia Impact Questionnaire (FIQ) 100-point scale. It showed a statistically significant group difference at the end of treatment (MD -15.40 points on a 100-point scale; 95% CI -25.62 to -5.18, P = 0.003), favouring acupuncture (Analysis 1.2).

Main outcome measure 3: Sleep

Sleep was measured using the subset 'rested' on the FIQ. It showed no statistically significant group difference at the end of treatment (MD -0.40 points on a 10-point scale; 95% CI -1.01 to 0.21, P = 0.20) (Analysis 1.3).

Main outcome measure 4: Fatigue

Fatigue was measured using the subset 'fatigue' on the FIQ. It showed a statistically significant group difference at the end of treatment (MD -1.10 points on a 10-point scale; 95% CI -1.98 to -0.22, P = 0.01), favouring acupuncture (Analysis 1.4).

Main outcome measure 5: Stiffness

Stiffness was measured using the subset 'stiffness' on the FIQ. It showed a statistically significant group difference at the end of treatment (MD -0.90 points on a 10-point scale; 95% CI -1.66 to -0.14, P = 0.02), favouring acupuncture (Analysis 1.5).

Main outcome measure 6: Adverse events

No adverse events were reported, only withdrawals and drop-outs. One patient from the acupuncture group and two from the control group left the study as their condition was not improving.

Minor outcome measure 1: Mental well-being

Mental well-being was measured using the subset 'depression' on the FIQ. It showed no statistically significant group difference at the end of treatment (MD -0.50 points on a 10-point scale; 95% CI -1.10 to 0.10, P = 0.10) (Analysis 1.7).

Long-term effect of acupuncture

There was no follow-up and long-term effect was not measured.

2) Real acupuncture versus placebo or sham acupuncture

Main outcome measure 1: Pain up to one month after treatment

Six studies totaling 286 participants were in this category (Assefi 2005; Deluze 1992; Harris 2005; Harris 2008; Harris 2009; Martin 2006). Measurement tools used included VAS (0 to 10 cm and 0 to 100 mm), numerical pain rating scale (NRS), Multidimensional Pain Inventory (MPI) and McGill Pain Questionnaire (SF-MPQ). Pooled analysis of the six studies showed no statistically significant difference between the groups in reducing pain (standardised mean difference (SMD) -0.14; 95% CI -0.53 to 0.25, P = 0.48; corresponding to a reduction of 2.8 points on a 100-point scale) (Analysis 2.1). Moderate heterogeneity was found (I^2 = 54%, P =

0.05) and is likely due to the two forms of acupuncture, electro- and manual, employed in the different studies.

Pain subgroup analysis (electro- versus manual acupuncture)

Pooled subgroup analysis of two electro-acupuncture studies, including 104 participants (Deluze 1992; Martin 2006), indicated that real electro-acupuncture was statistically significantly better than sham electro-acupuncture in reducing pain (SMD -0.63; 95% CI -1.02 to -0.23, P = 0.002, about 13 points on a 100-point scale) (Analysis 2.1) up to one month after treatment, with low heterogeneity (I^2 = 0%, P = 0.72). Subgroup analysis of four manual acupuncture studies, including 182 participants (Assefi 2005; Harris 2005; Harris 2008; Harris 2009) showed no group difference between real and sham manual acupuncture in reducing pain (SMD 0.14; 95% CI -0.17 to 0.45, P = 0.37, 2.8 points on a 100-point scale) (Analysis 2.1), with no heterogeneity (I^2 = 0%, P = 0.57). There was a statistically significant subgroup difference between electro- and manual acupuncture (Chi^2 = 8.94, P = 0.003).

Main outcome measure 2: Physical function (SF-36) up to one month after treatment

One study totaling 56 participants was in this category (Harris 2005). Physical function was measured with the SF-36. Analysis of the study indicated that sham manual acupuncture was superior to manual acupuncture in improving SF-36 physical function (MD -5.80 points on a 100-point scale; 95% CI -10.91 to -0.69, P = 0.03, Analysis 2.4).

Main outcome measure 3: Global well-being: rated by participants up to one month after treatment

Three studies totaling 200 participants were in this category (Assefi 2005; Deluze 1992; Martin 2006). Measurement tools included VAS and FIQ. Pooled analysis of the three studies showed no statistically significant difference between real and sham acupuncture (SMD 0.29; 95% CI -0.44 to 1.01, P = 0.44, 5.8 points on a 100-point scale) (Analysis 2.5), with high heterogeneity (I^2 = 81%, P = 0.003). This is likely due to the two forms of acupuncture, electro- and manual, employed in the different studies.

Global well-being subgroup analysis (electro-acupuncture versus manual acupuncture)

Pooled subgroup analysis of two electro-acupuncture studies with 104 participants (Deluze 1992; Martin 2006) indicated that real electro-acupuncture was statistically significantly better than sham electro-acupuncture in reducing global well-being as rated by participants (SMD 0.65; 95% CI 0.26 to 1.05, P = 0.001, about 11 points on a 100-point scale) (Analysis 2.5), up to one month after treatment, with low heterogeneity (I^2 = 0%, P = 0.99). Subgroup analysis of one manual acupuncture study of 96 participants (Assefi 2005) showed no difference between real and sham manual acupuncture (SMD -0.40; 95% CI -0.86 to 0.06, P = 0.09, about eight points worse on a 100-point scale) (Analysis 2.5). Subgroup comparison indicated that electro-acupuncture was statistically significantly better than manual acupuncture in improving global well-being as rated by participants up to one month after treatment (Chi^2 = 11.49 , P = 0.0007).

Main outcome measure 4: Sleep up to one month after treatment

Three studies totaling 200 participants were in this category (Assefi 2005; Deluze 1992; Martin 2006). Sleep quality was measured with a VAS sleep scale and the subset 'rested' on the FIQ. Pooled analysis showed no statistically significant difference with real acupuncture when compared with sham interventions (SMD 0.16; 95% CI -0.29 to 0.61, P = 0.49, about 3.2 points on a 100-point scale) (Analysis 2.7), with moderate heterogeneity (I^2 = 56%, P = 0.10).

Sleep subgroup analysis (electro-acupuncture versus manual acupuncture)

Pooled subgroup analysis of two electro-acupuncture studies with 104 participants (Deluze 1992; Martin 2006) indicated that real electro-acupuncture was statistically significantly better than sham electro-acupuncture in improving sleep quality (SMD 0.40; 95% CI 0.01 to 0.79, P = 0.05, about eight points on a 100-point scale) (Analysis 2.7) up to one month after treatment, with low heterogeneity (I^2 = 0%, P = 0.74). Subgroup analysis of one manual acupuncture study with 96 participants (Assefi 2005) showed no difference between real and sham manual acupuncture in improving sleep (SMD -0.25; 95% CI -0.71 to 0.21, P = 0.29, five points worse on a 100-point scale) (Analysis 2.7). Subgroup comparison indicated that electro-acupuncture was statistically significantly better than manual acupuncture in improving sleep up to one month after treatment (Chi^2 = 4.44 , P = 0.04).

Main outcome measure 5: Fatigue up to one month after treatment

Three studies totaling 201 participants were in this category (Assefi 2005; Harris 2005; Martin 2006). Fatigue was measured with a VAS, the Multidimensional Fatigue Inventory (MFI) and the subset 'fatigue' on the FIQ. Pooled analysis showed no statistically significant difference between real and sham acupuncture in reducing fatigue (SMD -0.10; 95% CI -0.81 to 0.61, P = 0.78, about 1.7 points on a 100-point scale, Analysis 2.9), with high heterogeneity (I^2 = 82%, P = 0.004). This is likely due to the two forms of acupuncture, electro- and manual, being employed in the different studies.

Fatigue subgroup analysis (electro-acupuncture versus manual acupuncture)

Subgroup analysis of one electro-acupuncture study (Martin 2006) of 49 participants indicated that real electro-acupuncture was statistically significantly better than sham electro-acupuncture in reducing fatigue (SMD -0.85; 95% CI -1.44 to -0.27, P = 0.004, about 15.3 points on a 100-point scale) (Analysis 2.9) up to one month after treatment. Pooled subgroup analysis of two manual acupuncture studies (Assefi 2005; Harris 2005) with 152 participants showed no group difference between real and sham manual acupuncture in reducing fatigue (SMD 0.26; 95% CI -0.08 to 0.61, P = 0.13, about 4.3 points worse on a 100-point scale) (Analysis 2.9), with low heterogeneity (I^2 = 0%, P = 0.39). Subgroup comparison indicated that electro-acupuncture was statistically significantly better than manual acupuncture in improving fatigue up to one month after treatment (Chi^2= 10.31, P = 0.001).

Main outcome measure 6: Stiffness up to one month after treatment

Two studies totaling 104 participants using electro-acupuncture treatment (Deluze 1992; Martin 2006) were in this category. Stiffness was measured as minutes (Deluze 1992) and the subset 'stiffness' on the FIQ (Martin 2006). Pooled analysis showed that real electro-acupuncture was statistically significantly better than sham

electro-acupuncture in improving stiffness (SMD -0.45; 95% CI -0.84 to -0.06, P = 0.02, nine points on a 100-point scale) (Analysis 2.11) up to one month after treatment, with low heterogeneity (I^2 = 0%, P = 0.42).

Main outcome measure 7: Adverse events

There were no serious adverse events reported. Minor adverse events were reported in 11 out of 113 participants in the acupuncture groups and 58 out of 156 in the control groups (risk ratio (RR) 0.44; 95% CI 0.12 to 1.63, P = 0.22, Analysis 2.13), with moderate heterogeneity (I^2 = 67%, P = 0.05). This could be due to the three sham groups in one study (Assefi 2005) reporting over 60% adverse events; this was much higher than the other studies, which were typically under 30%.

Minor outcome 1: Mental well-being up to one month after treatment

One study totaling 49 participants using electro-acupuncture was in this category (Martin 2006). Mental well-being was measured with the subset 'depression' of the FIQ. Analysis showed a statistically significantly better result with real electro-acupuncture when compared to sham electro-acupuncture in improving mental well-being (MD -1.70 points on a 10-point scale; 95% CI -3.13 to -0.27, P = 0.02) (Analysis 2.14), up to one month after treatment.

Minor outcome measure 2: Analgesic use (number of tablets) up to one month after treatment

One study with 55 participants using electro-acupuncture treatment (Deluze 1992) measured analgesic use by the number of tablets per week. There was no difference between real and sham electro-acupuncture (MD -3.20 tablets less per week; 95% CI -10.20 to 3.80, P = 0.37) (Analysis 2.16).

Minor outcome measure 3: Analgesic use (number of participants) up to one month after treatment

One study with 80 participants using manual acupuncture treatment (Assefi 2005) measured analgesic use by number of participants taking analgesics. There was no difference between real and sham manual acupuncture (RR 0.94; 95% CI 0.66 to 1.32, P = 0.71) (Analysis 2.17).

Minor outcome 4: Tenderness up to one month after treatment

One study with 55 participants using electro-acupuncture treatment (Deluze 1992) measured pressure pain threshold (kg/cm^2). Electro-acupuncture was better than sham electro-acupuncture in enhancing pain thresholds (MD 0.80 kg/cm^2 higher; 95% CI 0.02 to 1.58, P = 0.04) (Analysis 2.18), up to one month after treatment.

Minor outcome measure 5: Overall well-being: rated by care giver

One study with 55 participants using electro-acupuncture treatment (Deluze 1992) reported overall well-being rated by care givers. Analysis showed a statistically significantly better result with real electro-acupuncture when compared with sham electro-acupuncture (MD 2.00 points on a 10-point scale; 95% CI 0.81 to 3.19, P = 0.001) (Analysis 2.19), up to one month after treatment.

Long-term effects of acupuncture

Two studies (Assefi 2005; Martin 2006) measured long-term effects of acupuncture for up to seven months after the end of the treatment. There was no difference between real and sham acupuncture on any outcome measures, including pain (Analysis 2.2), global well-being (Analysis 2.6), sleep (Analysis 2.8), fatigue (Analysis 2.10), stiffness (Analysis 2.12) and mental well-being (Analysis 2.15). Subgroup comparison indicated that electro-acupuncture was not statistically significantly better than manual acupuncture at improving any of the outcomes at seven months after treatment.

Sham non-invasive (not breaking skin) acupuncture versus sham invasive (breaking skin) acupuncture

Four studies (Assefi 2005; Harris 2008; Harris 2009; Martin 2006) with 116 participants using non-invasive sham acupuncture were compared with three studies (Assefi 2005; Harris 2005; Deluze 1992) with 170 participants using invasive sham interventions. There was no statistically significant difference between the two subgroups on pain rating (Chi^2 = 0.40, P = 0.53, Analysis 2.3).

3) Real acupuncture versus standard or usual care (medication)

One study in this category (Guo 2005) included 38 participants and compared manual acupuncture with Western medicine (amitriptyline).

Main outcome measure 1: Pain at up to one month after treatment

Pain severity was measured using a VAS. It showed a statistically significant group difference favouring acupuncture (MD -17.30 points on a 100-point scale; 95% CI -24.13 to -10.47, P < 0.00001) (Analysis 3.1).

Main outcome measure 2: Adverse events

No adverse events were reported, however all participants were included in the final analyses. No withdrawals or drop-outs were reported either.

Minor outcome measure 1: Number of tender points at up to one month after treatment

A statistically significant group difference was shown for number of tender points, favouring acupuncture (MD -4.00 number of tender points; 95% CI -6.73 to -1.27, P = 0.004) (Analysis 3.3).

Long-term effect of acupuncture at the sixth month after treatment

The authors stated there was follow-up at six months but no data were provided.

The poor reporting of the trial raises questions about its quality. For example, the authors claimed 'cure' of 12 fibromyalgia participants, with nine in the acupuncture group and three in the control, without a definition of what 'cure' was, except for saying "signs and symptoms free with no tender point" without further explanation as to which time point these were measured at.

4) Real acupuncture as an adjunct therapy

One study in this category (Targino 2008) with 58 participants compared manual acupuncture plus standard therapy, which included tricyclic antidepressants and exercise, with standard therapy alone.

Main outcome measure 1: Pain at up to one month after treatment

Pain severity was measured using a VAS. It showed a statistically significant group difference favouring acupuncture (MD -3.00 points on a 10-point scale; 95% CI -3.90 to -2.10, P < 0.00001) (Analysis 4.1).

Main outcome measure 2: Adverse events

There were no serious adverse events reported. No group difference in the number of minor adverse events was found (RR 3.57; 95% CI 0.18 to 71.21, P = 0.40) (Analysis 4.3).

Minor outcome measure 1: Tenderness - number of tender points below kg/cm^2 up to one month after treatment

Tenderness was measured the number of tender points below the threshold. The results showed a statistically significant group difference favouring acupuncture (MD -4.50 number of tender points; 95% CI -6.20 to -2.80, P < 0.00001) (Analysis 4.4).

Minor outcome measure 2: Tenderness - mean pressure threshold by pressure algometry at end of treatment

Tenderness was measured with the mean pressure threshold (kg/cm^2). The results showed a statistically significant group difference (MD 0.70 kg/cm^2; 95% CI 0.41 to 0.99, P < 0.00001) (Analysis 4.6), favouring acupuncture.

Long-term effect of acupuncture (follow-up at six months)

At the six-month follow-up, the acupuncture as an adjunct therapy group continued to be better than the standard therapy alone group for tender points (MD -2.00 number of tender points; 95% CI -3.51 to -0.49, P = 0.009) (Analysis 4.5) and mean pressure pain threshold (MD 0.60 kg/cm^2; 95% CI 0.26 to 0.94, P = 0.0005) (Analysis 4.7) but not pain (MD -0.50 points on a 10-point scale; 95% CI -1.49 to 0.49, P = 0.37) (Analysis 4.2).

5) A particular style of acupuncture versus another (deep invasive needling with stimulation (deqi) (T/S) versus deep invasive needling without stimulation (T/O))

Two different styles of acupuncture, deep needling using manual acupuncture on the point with stimulation to achieve *deqi* as in traditional Chinese acupuncture (T/S) versus deep needling on the point without stimulation (T/O), were compared in one study of 41 participants (Harris 2005).

Main outcome measure 1: Pain at the end of the treatment

Pain was measured using the NRS. It showed no statistically significant difference between the two interventions (MD 0.30 on a 10-point scale; 95% CI -18.34 to 18.94, P = 0.97) (Analysis 5.1).

Main outcome measure 2: Physical function (SF-36) at the end of the treatment

Physical function was measured using the SF-36 (physical). There was no group difference between the two interventions (MD -5.50 points on a 100-point scale; 95% CI -11.43 to 0.43, P = 0.07) (Analysis 5.2).

Main outcome measure 3: Fatigue at the end of the treatment

Fatigue was measured using the MFI. There was no group difference between the two interventions (MD 1.10 points on 20-point scale; 95% CI -1.41 to 3.61, P = 0.39) (Analysis 5.3).

DISCUSSION

Summary of main findings

Out of 124 studies screened, we identified nine randomised controlled trials (RCTs) involving 395 participants. Most of the studies were excluded because of insufficient data. All selected studies used a fixed set of acupuncture points (formula acupuncture) with six using manual acupuncture and three electro-acupuncture.

When compared with the group not receiving acupuncture, the acupuncture treatment group improved in terms of pain, global well-being, fatigue and stiffness, but not sleep. We found no difference between real and sham acupuncture on any outcome measures except for stiffness and physical functioning. Stiffness was measured in two electro-acupuncture studies, which showed a moderate effect of electro-acupuncture over sham interventions. On the contrary, sham intervention produced better improvement in physical functioning. Subgroup analyses demonstrated that electro-acupuncture was consistently better than manual acupuncture in eliciting moderate benefits on pain, fatigue, sleep and global well-being as rated by participants.

Comparing acupuncture with standard pharmacotherapy (amitriptyline), the result of a single trial favoured acupuncture for pain and muscle tenderness. The quality of that paper was poor, affecting the validity of the result. One study examined acupuncture as an adjunct therapy to standard care comprising of a tricyclic antidepressant and exercise and found an additive effect of acupuncture for pain relief and reduction of muscle tenderness.

Measurement of treatment effects was within one month of the end of treatment. Many effects of acupuncture were short-lasting and not maintained at six to seven-month follow-ups. Adverse events reported were mild and no difference between real and sham acupuncture, or other control interventions, was found.

Overall, there is a low to moderate level of evidence indicating that formula acupuncture could be a safe option for fibromyalgia. There is a low to moderate level of evidence that acupuncture is better than non-acupuncture, Western medication and standard therapy in improving pain and stiffness for people with fibromyalgia. There is a moderate level of evidence that the effect of acupuncture does not differ from sham acupuncture in terms of reduction of pain, fatigue, improvement of sleep or global well-being. Subgroup analyses indicate that electro-acupuncture was consistently better than sham interventions. When considering acupuncture, electro-acupuncture could be an effective modality for short-term pain relief. We reached these gradings because of the small sample sizes in all included studies, although the risks of biases were low. None of the studies had more than 50 participants in any of the trial arms and there is a possibility of random errors due to small sample size. As a result, our findings warrant further research with an adequate sample size and long-term follow-up.

Quality of the evidence

With additional information provided by the authors, we were able to ascertain that the risk of bias of the included studies was acceptable in all studies except for three pragmatic trials (Guo 2005; Itoh 2010; Targino 2002). The other six studies (Assefi 2005; Deluze 1992; Harris 2005; Harris 2008; Harris 2009; Martin 2006) that compared acupuncture with sham controls included acupuncture-naive participants, adopted adequate randomisation procedures, blinded assessors, properly recorded drop-outs and five out of six studies used intention-to-treat analysis. Five studies also blinded participants (Assefi 2005; Harris 2005; Harris 2008; Harris 2009; Martin 2006), tested the blinding of participants (except for Harris 2008) and reported that the participants could not tell to which group they were allocated. We consider that the risk of bias is low in these six out of the nine included studies.

Acupuncture versus non-acupuncture

There is low-quality evidence based on one trial (electro-acupuncture, 13 participants) that acupuncture significantly reduced pain and stiffness and improved global well-being and fatigue when compared with the non-acupuncture group. We downgraded the quality of evidence because participant blinding was impossible, intention-to-treat analysis was not used and due to the small sample size. Adverse events were not reported. Three participants withdrew due to ineffective treatment (Summary of findings for the main comparison).

Acupuncture versus sham acupuncture

There is moderate-quality evidence based on data from six trials (289 participants) (combined manual and electro-acupuncture) that acupuncture did not significantly reduce pain compared with sham acupuncture, but subgroup analysis indicates that electro-acupuncture was significantly better than sham electro-acupuncture; whereas manual acupuncture showed no significant difference from sham manual acupuncture. Based on one manual acupuncture trial (56 participants), there is moderate-quality evidence that sham acupuncture improved physical function better than acupuncture, with the quality being downgraded due to inconsistency with other outcome measures. Global well-being has moderate-quality evidence based on three trials (203 participants, combined manual and electro-acupuncture) that acupuncture was not better than sham acupuncture, with subgroup analysis indicating that electro-acupuncture showed greater improvement than manual acupuncture did. Sleep had moderate-quality evidence with data from three trials (203 participants) that acupuncture (combined electro- and manual) did not significantly improve sleep time over sham acupuncture. However, subgroup analysis indicates that electro-acupuncture improved sleep quality significantly. We downgraded the quality of evidence for 'pain', 'global well-being' and 'sleep' due to one study (Deluze 1992) not using intention-to-treat analysis. There is high-quality evidence based on three trials (204 participants, combined manual and electro-acupuncture) that acupuncture did not significantly reduce fatigue, however subgroup analysis indicates that electro-acupuncture reduced fatigue significantly. Stiffness has moderate-quality evidence based on two trials (104 participants, electro-acupuncture only) that acupuncture significantly reduced stiffness compared with sham acupuncture and was downgraded due to one study (Deluze 1992) not using intention-to-treat analysis. Moderate-quality evidence from six trials (289 participants) showed no statistically significant difference between real and sham acupuncture in the number of adverse events associated with acupuncture. We downgraded the quality due to the small sample size within the studies. One in six people who had acupuncture reported adverse events, in contrast to one in three in the sham treatment groups. Such events were minor and lasted less than one day (Summary of findings 2).

Acupuncture versus medication

There is low-quality evidence based on one trial (38 participants, manual acupuncture only) that acupuncture significantly reduced pain when compared with medication. We downgraded the quality of evidence due to the poor reporting of the paper. No details about adverse events were reported. From the data it would appear that there were no drop-outs or withdrawals (Summary of findings 3).

Acupuncture as an adjunct therapy

There is moderate-quality evidence based on one trial (manual acupuncture, 58 participants) that acupuncture significantly reduced pain as an adjunct therapy to medication and exercise. We downgraded the quality of evidence due to the small sample size. There were two adverse events in the acupuncture group, which was not significantly different from the control group. We downgraded the evidence due to small sample size (Summary of findings 4).

Deep needling with stimulation versus deep needling without stimulation

There is moderate-quality evidence based on one trial (manual acupuncture, 41 participants) which showed that there was no significant difference between the two needling styles in the reduction of pain or improvement of their physical function. We downgraded the evidence due to small sample size (Summary of findings 5).

Comparison with other systematic reviews

Three meta-analyses of RCTs of acupuncture for the treatment of fibromyalgia have recently been published (Cao 2010; Langhorst 2010; Martin-Sanchez 2009) with conflicting conclusions. Cao 2010 considered that acupuncture could be a safe and effective therapy for treating fibromyalgia, while Martin-Sanchez 2009 and Langhorst 2010 concluded that acupuncture was neither effective nor could the effect be distinguished from bias.

In comparison, the present review has the following strengths: our search was comprehensive, including both English and Chinese databases; we adopted strict trial selection criteria based on the American College of Rheumatology (ACR) requirements; the adequacy of acupuncture protocol and treatment delivery were assessed by experts in the field; we contacted all authors to obtain additional data; we extracted data for multiple outcome measures and we limited acupuncture intervention to needling only. Laser acupuncture differs from manual or electro-acupuncture due to its mechanism and depth of stimulation. We selected studies using invasive needling acupuncture as the main or adjunct therapy. Consequently, all studies identified for inclusion in those three reviews have been either included in or excluded from our review. Martin-Sanchez 2009 only examined pain and did not include other outcome measures that are associated with fibromyalgia. Langhorst 2010 included most of the studies selected for this review. Langhorst 2010 found the reduction of

pain to be significantly better in the real acupuncture group post-treatment (standardised mean difference (SMD) -0.25; 95% confidence interval (CI) -0.49 to -0.02, P = 0.04) and their effect size was smaller when compared with our data (SMD -0.42) due to inclusion of two studies that we excluded (Lautenschlager 1989; Sprott 1998) for not using ACR criteria or not reporting confirmable data, respectively. They also excluded one study which was included in our review (Harris 2008). Langhorst 2010 went on to conclude that "significant reduction of pain was only present in studies with risk of bias" because they considered three positive studies (Assefi 2005; Deluze 1992; Martin 2006) as having a high risk of bias. As indicated in Figure 3 and Figure 2, our data do not support this claim as explained above in the 'Quality of the evidence' section. We also included three other studies comparing acupuncture with non-acupuncture, medication and standard therapy.

Outcome measures for fibromyalgia

The top three core domains for outcome measures in any pain studies as recommended in IMMPACT are pain, function and emotion (Dworkin 2010). Furthermore, the 2010 ACR preliminary diagnostic criteria identified pain as well as a range of non-pain symptoms, for instance cognitive symptoms, headache and irritable bowel syndrome (Wolfe 2010). In all studies included in this review, the measurement tools for pain were adequate and validated. However, only four studies measured function or quality of life, two studies measured mental well-being, with one using the depression and anxiety sub-scales of the Fibromyalgia Impact Questionnaire (FIQ) and the other using the mental component of the SF-36. None measured cognition or somatic symptoms apart from sleep and fatigue. The FIQ, a condition-specific, validated function measure, was used only in two studies (Itoh 2010; Martin 2006). The FIQ has been in existence for 18 years and translated into eight languages (Bennett 2005). Targino 2008 explained they could not use the FIQ because the Brazilian version had not been validated at the time of the trial. The other two (Assefi 2005; Harris 2005) used the SF-36, which assesses quality of life but not function in fibromyalgia. The data from Assefi 2005 could not be used for the current review due to incorrect labelling of data in the published papers. To our knowledge, there is only one trial comparing the FIQ and the SF-36 in fibromyalgia and rheumatoid arthritis participants (Birtane 2006). The total score on the FIQ was moderately correlated with physical function, physical role and bodily pain on the SF-36, but not with other domains. Sub-scales of the FIQ were not correlated with relevant domains on the SF-36. For instance, bodily pain on the SF-36 was correlated with stiffness but not pain on the FIQ, and mental health on the SF-36 was correlated with anxiety but not depression on the FIQ. For this reason, we analysed data from the SF-36 and the FIQ separately, with the SF-36 measuring physical and mental function and the FIQ measuring overall well-being. We question the suitability of the SF-36 for measuring function in fibromyalgia participants. Physical function measured with the SF-36 physical domain was poorer in the acupuncture group than in the sham intervention group. The change was statistically, but not clinically, significant. We could not explain this finding. Given that the finding was from one trial, future studies with large sample sizes might impact on the direction of changes.

Fibromyalgia is characterised by widespread chronic pain as well as a range of non-pain symptoms and co-morbidities. A recent review indicates that when rating global improvement, fibromyalgia participants consider not only pain reduction, but also improvement in fatigue, functioning, mood and daily living (Hudson 2009). It is therefore important to assess a wide range of measures when examining the effect of any interventions for fibromyalgia. The FIQ consists of measures of pain, fatigue, sleep and physical and emotional functioning and is an ideal outcome measurement tool. OMERACT (Outcome Measures in Rheumatology) participants have agreed that pain, tenderness, fatigue, participant global rating or well-being, function and sleep are the core outcomes to be measured (Mease 2009). The FIQ measures most of these domains. In future studies, researchers should consider using the FIQ or include the assessment of the key co-morbidities and emotional and cognitive aspects of fibromyalgia. Such a design would help identify the specific effects of acupuncture on fibromyalgia.

Quality of acupuncture treatment

Overall, the treatment was adequate in terms of frequency (two to three sessions per week), number of treatments (six to 28 sessions) and length of each session of treatment (20 to 30 minutes). However, reporting of some details of the treatment, such as needling depth and unilateral or bilateral needling, were unavailable. It is important that both authors and journals adhere to the STRICTA guidelines for adequate reporting of acupuncture treatments.

The major weakness of reporting of acupuncture treatments was a lack of rationale for the acupuncture treatment in all but one included trial (Deluze 1992), and justification of point selection was rarely provided, which could be due to a lack of standard Chinese medicine syndrome differential criteria for fibromyalgia. Acupuncture therapy in a clinical setting relies on the syndrome pattern differentiation for accurate point selection. None of the studies included offered a diagnosis or attempted a syndrome pattern differentiation for fibromyalgia according to Chinese medicine.

The current Western medicine diagnosis of fibromyalgia does not result in a single entity or homogenous group. Reliance on the two main criteria of chronic widespread pain and 11 out of 18 tender points according to the ACR diagnostic criteria has been criticised for not considering other important symptoms and co-morbidities (Mease 2005; Wilke 2009; Wolfe 2003). It was never intended for the ACR criteria to be used for clinical diagnosis but rather for research as a standardised definition of fibromyalgia, and there is no gold standard for fibromyalgia diagnosis (Katz 2005). To address this, Western medical research is being undertaken to examine the differentiation of fibromyalgia into subgroup/symptom clusters (Muller 2007; Schneider 2005; Wilson 2009). The 2010 ARC preliminary criteria (Wolfe 2010) are a positive step towards clinically orientated approaches.

Although fibromyalgia is not a diagnosis of Chinese medicine, the types of pain and co-morbidities associated with it may fit into the Chinese medicine diagnostic concept of *Bi*-Syndrome, documented 2500 years ago (Ni 1995). Dividing *Bi*-Syndrome into a number of patterns depends on the characteristics of pain, as well as the accompanying signs and symptoms, which allows syndrome pattern differentiation, leading to an individualised approach to treatment that is part of the clinical decision-making process within traditional/clinical acupuncture practice. However,

the Chinese medicine diagnostic criteria for fibromyalgia are yet to be developed. This might explain why only formula acupuncture treatments were used in all included studies. It is common in modern Chinese medicine for a disease or condition in Western medicine to be given a set of differentiation diagnoses so that understanding of subgroups can be standardised to provide guidance for treatment. There is an urgent need for research into developing Chinese medicine syndrome differentiation diagnostic criteria.

Modes of acupuncture

The current data do not allow us to conclude the best acupuncture stimulation mode for the treatment of fibromyalgia. However, only one trial examined the two types of stimulation, and found deep needling with stimulation did not differ from deep needling without stimulation. That is to say *deqi*, one of the essences of acupuncture stimulation, might not play the expected role in the treatment of fibromyalgia. Subgroup analyses indicate that electro-acupuncture was consistently superior to manual acupuncture for a number of major outcome measures. However, no trial directly compared electro- with manual acupuncture.

Sensitivity of the nervous system of fibromyalgia participants may influence the treatment outcome of different types of stimulation, however dose of treatment could be another explanation. A recent trial in healthy humans compared the effect of sham acupuncture with manual and electro-acupuncture on electrical pain thresholds (Zheng 2010). The researchers found that electro-acupuncture induced the best analgesia, followed by manual acupuncture, then the sham intervention. In electro-acupuncture, the stimulation was delivered constantly for 25 minutes, whereas in manual acupuncture the stimulation was about one minute and in sham acupuncture was close to zero. The treatments were similar to those in the selected studies for this review. That is, any difference between electro- and manual or manual with sham manual acupuncture could be due to the duration and strength of stimulation, or dose. This hypothesis will need to be tested in a trial examining all three modes of stimulation in the fibromyalgia population.

Challenges of sham acupuncture design in fibromyalgia studies

Sham acupuncture controls varied amongst the studies. We conducted a subgroup analysis comparing studies using invasive sham acupuncture with studies using a non-invasive method and found no subgroup difference. This comparison is, however, influenced by the small number of studies and mixed studies using electro- and manual acupuncture. Consequently, we could not draw a strong inference as to what the ideal sham control is. Sham controls were non-invasive (Assefi 2005 (one arm) and Harris 2008; Harris 2009; Martin 2006), invasive, off the point/channel (Assefi 2005 (one arm); Deluze 1992; Harris 2005 (two arms)) plus invasive on irrelevant point (Assefi 2005 (one arm)). The inert nature of these sham methods is debatable and no agreed standard for sham controls exists for acupuncture (Birch 2006). Penetrating the skin anywhere would appear to activate one of the commonly proposed mechanisms of acupuncture analgesia, i.e. diffuse noxious inhibitory control (Lewith 1983; Pomeranz 1988). Four of the included studies reported that their choice of sham might in fact be active (Assefi 2005; Harris 2005; Martin 2006; Targino 2008). Indeed, in a trial comparing muscle blood flow in fibromyalgia participants with that of healthy controls, the researchers found that in healthy controls only deep needle insertion into an acupuncture point increased blood flow, but in fibromyalgia participants both shallow and deep insertion were equally effective (Sandberg 2004).

In a review, Lundeberg 2007 questioned whether sham acupuncture was a valid procedure for fibromyalgia participants due to their dysfunctional central nervous system (central sensitisation). As such, the nervous system may be responsive to the sub-pain threshold stimulus involved in any invasive sham acupuncture, subsequently activating the endogenous pain inhibition pathways (Mense 2003) that are usually activated by painful stimulation. Further clouding the issue is the result of a positron emission tomography (PET) trial of participants with fibromyalgia (Harris 2009). They found no difference between real manual acupuncture and non-invasive sham manual acupuncture in pain reduction. However, they identified significant group difference in brain activities. Morphine binding potential was increased in the real manual acupuncture group in the brain centres that modulated pain, whereas it was reduced or there was no change in the non-invasive sham manual acupuncture group. The results indicate that a non-invasive sham acupuncture technique may become active treatment in this population group, and its mechanism is likely due to non-opioid mediated pain modulation. This might also explain why there was no difference between deep needling with and without stimulation.

The placebo effect, including a range of components such as patient expectation, patient/therapist relationship and conditioning, has also been considered as one of the mechanisms explaining acupuncture analgesia (Finniss 2010). An analysis of data from four acupuncture trials totaling 864 participants concluded that there is a strong association between expectation and pain relief (Linde 2007). In a qualitative study, Kerr and colleagues (Kerr 2011) found that trial participants interpreted the sensation elicited by non-invasive placebo acupuncture needles as being meaningful and therapeutic. Those studies indicate that acupuncture is a complex intervention with multiple components. Indeed, some researchers challenge the usefulness of sham acupuncture controlled trials (Langevin 2011).

However, having some form of placebo is important in establishing the efficacy of a therapy. Future studies need to identify an adequate sham acupuncture intervention for fibromyalgia participants before studies are commenced. It is also important to conduct high-quality pragmatic trials to compare acupuncture with other proven therapies. In the current review, we found that acupuncture was superior to antidepressants and a combination of antidepressants and exercise for fibromyalgia, but the findings were from two studies with a small sample size.

Reporting of adverse events

We identified inconsistent reporting of adverse events in the included studies, with some studies reporting no adverse events (Harris 2005; Harris 2008) and others reporting 53% of participants experiencing them (Assefi 2005). So far, there is no uniform understanding of what constitutes an adverse event in acupuncture treatment or what should be recorded. For example, should 'pain at site of needling' be an adverse event, when for some techniques this is normal? Is being 'relaxed/tired' an adverse event or a typical indication of the therapeutic effect of acupuncture?

The discrepancy of reporting adverse events is also reflected by other published studies. For example, one clinic audit found that bleeding occurring in 53% cases and pain in 24% (White 2001), whereas another reported bleeding in 0.4% and pain in 1.2% of cases (MacPerson 2001). Although the former study audited treatments performed by medical or physiotherapy acupuncturists and the latter by traditional Chinese acupuncturists, the significant differences are likely due to reporting discrepancy and the definition of adverse events. Generally, acupuncture is considered safe. A consensus on how to report adverse events in acupuncture treatment is needed.

AUTHORS' CONCLUSIONS

Implications for practice

Due to the weaknesses of the included studies, the implications for practice are limited. Overall, there is a low to moderate-quality level of evidence that formula acupuncture for the treatment of fibromyalgia is safe. There is a moderate level of evidence that acupuncture is not better than sham controls. Electro-acupuncture is found to be consistently better than sham interventions in improving pain, global well-being, sleep, stiffness and fatigue. The effect of acupuncture was not maintained at six to seven months after treatment. The same level of evidence supports acupuncture as an adjunct therapy to medication and exercise or acupuncture when compared with a medication and exercise control. When comparing acupuncture with medication or a wait list, there is low quality evidence in favour of acupuncture but this needs more rigorous and methodologically sound studies.

Evidence suggests that treatment sessions should be twice per week, over four weeks, with each session lasting for 25 minutes. Electro-acupuncture seems to provide a number of benefits for fibromyalgia participants. Practitioners should consider electro-acupuncture with 2 to 5 Hz electrical stimulation and acupuncture points could include ST36 and LI4. Optimal needling depth, point selection and needle stimulation are yet to be identified.

Like any treatment for chronic pain, maintenance acupuncture treatment is likely to be required for long-term benefit for fibromyalgia. How frequent the treatment should be is unknown.

Implications for research

We recommend a number of ways in which to address the weaknesses identified in the included studies. To further test the usefulness of acupuncture in treating fibromyalgia, researchers need to develop Chinese medicine diagnostic and subgroup differentiation criteria. The suitability of any sham acupuncture needs to be tested in this population prior to any further studies. In regards to the safety profile, a clear definition of what adverse events are associated with acupuncture is needed. Future studies testing the efficacy of acupuncture should use an adequate sample size, apply electro-acupuncture and assess the long-term results. Use of a disease-specific tool, such as the Fibromyalgia Impact Questionnaire, and accurate reporting of treatment using the Standards for Reporting Interventions in Controlled studies of Acupuncture (STRICTA) guidelines would be desirable. Future studies also need to assess how often acupuncture should be delivered to maintain its long-term benefit and the cost-effectiveness of such a treatment plan.

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* Indicates the major publication for the study

CHARACTERISTICS OF STUDIES

Characteristics of included studies *[ordered by study ID]*

Assefi 2005

Methods	*Randomised*: computer-generated blocked random allocation sequence with block size of 4. Researcher not involved in the study conducted randomisation (used academic research centre). *Blinding*: participants blinded during treatment. Staff who collected and analysed the data were blinded to treatment group. Care givers were not blinded to group allocation. *Setting*: individual private offices, does not state where these are *Was study aim clear*: yes *Informed consent*: verbal and written *Ethics approval*: institutional review boards at participating institution *WHO clinical trial register*: listed and outcomes as per listing *Intention-to-treat used*: yes *Follow-up*: 3 and 6 months
Participants	*Total number of participants*: 100 participants, mean duration of illness (years): directed acupuncture: 6 years SD 5; sham control groups: acupuncture for unrelated condition 5 years SD 3; sham needling 7 years SD 6; simulated acupuncture 7 years SD 4 2 male and 94 female *Mean age*: directed acupuncture; 46 years SD 11; sham control groups: acupuncture for unrelated condition 46 years SD 11; sham needling 49 years SD 14; simulated acupuncture 48 years SD 10 *Diagnosis*: ACR *Acupuncture-naive participants*: yes *Excluded*: other pain conditions, contraindicated for acupuncture (bleeding disorders, severe needle phobia), pregnant or breastfeeding, use of narcotics, litigation and previous acupuncture treatments *Recruitment source*: the Greater Seattle, Washington State metropolitan area using newspaper, television, university-affiliated hospitals, local fibromyalgia support groups and health care providers

Assefi 2005 *(Continued)*

	Previous treatments: manual (physical, ergonometric, chiropractic, massage), mental health therapies (psychotherapy, cognitive behavioural therapy), dietary changes or other (nerve blocks, hypnosis or biofeedback)
Interventions	1) *Real*: directed acupuncture Randomised to this group: 25 (analysed 25) 2) *Control*: acupuncture for unrelated condition, treating for irregular menses or early menses due to Blood Heat Randomised to this group: 25 (analysed 25) 3) *Control*: sham needling, using body points not recognised as true acupuncture points Randomised to this group 24 (1 did not complete baseline questionnaire) (analysed 24) 4) *Control*: simulated acupuncture; same acupuncture points as directed acupuncture but with tooth-pick inside a needle guide tube to mimic needle insertion/withdrawal Randomised to this group 25 (analysed 25) *Minimum number of treatments needed*: possible 24 treatments, required to attend 80% (19/24) *Co-interventions*: maintain current use of pharmacological and non-pharmacological therapies through out the study *Acupuncturists*: 8 US trained and licensed with median of 10 years experience (range 4 to 18 years) See STRICTA table for treatment details (Appendix 10)
Outcomes	*Primary outcomes*: 1) Pain; visual analogue scale (VAS) (0 = no pain, 10 = worst ever) 2) Function: Short-Form 36 health survey, mean of 50 and standard deviation of 10, with higher scores indicating better functioning *Secondary outcomes*: 3) Fatigue: VAS (0 = none, 10 = worst ever) 4) Sleep: VAS (0 = worst ever, 10 = best ever) 5) Over well-being: VAS (0 = worst ever, 10 = best ever) *Outcome measures primary and secondary*: 1), 2), 3), 4), 5) taken at weeks 1, 4, 8, 12 and 3 and 6 months 6) *Blinding*: participants rated how certain they were that they had received directed acupuncture or stimulated acupuncture on a 7-point scale (1 = very sure, 7 = very uncertain) measured at 12 weeks 7) *Acupuncturist*: participants rated acupuncturist skill level (1 = high, 7 = low) and adverse events measured at weeks 1, 4, 8 and 12 8) *Other co-interventions*: medication use measured at week 1 and week 12 *Outcome measure results*: "No significant differences were detected between the directed acupuncture and the pooled control group for any of the study outcomes". For the blinding procedures, "32% believed they were receiving acupuncture specifically designed for FM"; no significant difference between the groups (P > 0.2). 4% believed they were receiving simulated acupuncture; no difference between the groups (P > 0.2).

Assefi 2005 *(Continued)*

Combined groups had no significant difference in the skill of the acupuncturist (P > 0.2). 77% rated their skill as high, 5% as medium, 17% did not know

84% in the directed group and 79% of the pooled sham groups completed the full course of treatment. On average 21/24 (P > 0.2).

Total medication use showed no significant difference between groups (P > 0.2). Most commonly used medications were ibuprofen, acetaminophen and naproxen.

Withdrawals/drop-outs: 4 in at the randomised stage, 10 at the allocated intervention stage, directed group 2, unrelated acupuncture treatment 2, sham acupuncture 2 and simulated acupuncture 4

Complications/adverse events: 89 participants reported adverse events. 37% reported discomfort at site of needle insertion or simulation of needles, 3% reported nausea, 0.3% felt faint. Participants in simulated acupuncture (39%) had less discomfort than directed acupuncture (61%), while unrelated acupuncture (70%) and sham acupuncture (64%) were similar to directed. Bruising was reported less in the simulated acupuncture group (10%), while directed acupuncture (52%) it was reported more, the unrelated treatments (74%) was the worse, with sham acupuncture (68%) being similar to the last 2 groups.

Data extraction methods: data were extracted from the published paper. We selected the 'directed acupuncture' group as the real acupuncture treatment and we combined all the control arms as the sham acupuncture control as per the Cochrane Handbook and confirmed with the Cochrane editors. Mean data were measured from Figure 2 in the published data and SD was taken from baseline as this was not provided in the figure and was not published anywhere else. For the comparison of invasive and non-invasive sham controls we used the 'simulated acupuncture' as it was the same tool (Sherman 2002) as used in both the Harris 2008 and Harris 2009 studies. We could not extract data from the SF-36 graphs (Figure 3) as both graphs were labelled as SF-36 Physical Component.

Notes

Other info: 1 author was contacted by e-mail and confirmed intention-to-treat, however no further information was given about data or in response to other questions we had

Refunded costs to participants: not reported

Funding: NCCAM

Language: English

Publication: full paper

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Computer-generated random number
Allocation concealment (selection bias)	Low risk	Blocked random allocation sequence with block size of 4 with an independent researcher advising the acupuncture clinic of treatment assignment
Incomplete outcome data (attrition bias) All outcomes	Low risk	Data from 7 participants were not included in the analysis. However, the missing outcome data were balanced across the groups and less likely to have impacted on the outcome.
Selective reporting (reporting bias)	Low risk	All outcomes reported, as per WHO clinical trials register
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Restricted conversation during treatment, participants blindfolded and used acupuncture-naive participants. Care giver not blinded to group allocation. Participants tested for blinding could not detect which group they belonged to at the end of treatment.

Assefi 2005 *(Continued)*

Blinding of outcome assessment (detection bias) All outcomes	Low risk	Data collection staff and data analysts were blinded to treatment group

Deluze 1992

Methods	*Randomised*: electronic number generator, closed envelopes, numbered 1 to 70, prepared before study and opened in numerical order after recruitment *Blinding*: participants and outcomes assessors were blinded. Care giver was NOT blinded to group allocation. *Setting*: University Hospital, Geneva, Switzerland *Was study aim clear*: yes *Informed consent*: verbal and written *Ethics approval*: Department of Medicine ethics committee *WHO clinical trial register*: not listed as had not been established when study undertaken *Follow-up*: none *Intention-to-treat used*: not stated, but in the results section it states that the 15 participants that withdraw were not re-evaluated. Martin 2006 in their journal article stated that analysis used intention-to-treat, yet the review by Berman 1999 using intention-to-treat, found 42% had no benefit, 39% had satisfactory benefit, while 19% had an unexpectedly large benefit. In a recent review this detail was omitted by (Mayhew 2007). Assefi 2005 and Harris 2005 also did not mention this point in their discussion about other studies.
Participants	*Total number of participants*: 70 participants, mean duration of disease (years); real acupuncture = 14.4 years (3.7) (6.9 to 22.0), control = 6.9 years (1.3) (4.3 to 9.6) 16 male and 54 female (excess of men in the control group P = 0.015) *Mean age (years)*: real acupuncture = 46.8, control = 49 *Diagnosis*: ACR *Acupuncture-naive participants*: yes *Excluded*: severe concomitant disease, use of morphine-like drugs or anticoagulants, peripheral neuropathy, bleeding disorders, language difficulties and past use of acupuncture *Recruitment source*: referred, but does not state where from *Previous treatments*: not reported
Interventions	1) *Real*: electro-acupuncture (visible muscle contraction) Randomised to this group: 36 (analysed 28) 2) *Control*: sham electroacupuncture, similar number of needles except off the acupuncture point by 20 mm and current used on electro-stimulator was weaker than the real group. No increase in electrical volume was applied once the threshold of perception had been reached. Randomised to this group: 34 (analysed 27) *Co-interventions*: individual treatments continued, physiotherapy, anti-inflammatory agents, tricyclic antidepressants and analgesics.

Deluze 1992 *(Continued)*

	See STRICTA table for treatment details (Appendix 10).
Outcomes	*Primary outcomes*: 1) Pain; visual analogue scale (1 to 100 mm) *Secondary outcomes*: 2) Pain threshold, measured by pressure gauge over the 18 tender points as defined by ACR, before and after treatment 3) Analgesic use, tablets. Initial measurements taken in the week before the evaluation took place 4) Regional pain score, body drawing in which 21 regions are indicated. Patient assesses their pain in each region on a scale of 1 to 5, with 5 being the worst. 5) Sleep quality scale (1 to 10), with 10 being the best 6) Morning stiffness, measured in minutes 7) Patient general state (1 to 10), measured by patient, with 10 being the best 8) Evaluating physician impression (1 to 10), measured by physician as to the patient's general state, with 10 being the best Outcome measures taken before and after treatments completed *Outcome measure results*: Overall approximately 50% improved significantly, 25% had no change with the balance showing "unexpectedly large improvement, with almost complete disappearance of symptoms"; 1 in the control group was observed to have a similar result Real group improved significantly in 5 out of the 8 areas except morning stiffness Pain threshold improved by 70% in the real group as opposed to 4% in the control group *Withdrawals/drop-outs*: real acupuncture = 8, control group = 7 *Complications/adverse events*: real electroacupuncture 6 (2 = increase in symptoms, 3 = unpleasantness of needle sensation, 1 = ankle oedema). Sham electroacupuncture 5 (4 = increase in symptoms, 1 = unpleasantness of needle sensation) *Data extraction method*: data were extracted from the published paper using table 2 and ZZ converted the SE data to SD. We selected the 'VAS pain scale' rather than the 'regional pain score' as it was the most used measurement tool for pain.
Notes	*Other info*: e-mail contact was made with lead author who stated they were too busy to answer questions *Refunded costs to participants*: not reported *Funding*: not stated *Language*: English *Publication*: full paper

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Electronic number generator

Deluze 1992 *(Continued)*

Allocation concealment (selection bias)	Low risk	Closed envelopes, numbered 1 to 70, prepared before study and opened in numerical order after recruitment
Incomplete outcome data (attrition bias) All outcomes	High risk	11 participants dropped out from the study, and their data were not included in the whole analysis. Number of participants dropped out from the study and reasons for drop-out were comparable in both groups (5/27; 6/28). As nearly 80% of those dropped out were due to increased symptoms, attrition bias is possible although this was comparable in both treatment groups.
Selective reporting (reporting bias)	Low risk	WHO clinical trials register was not established at time of publication
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Used acupuncture-naive participants, care giver not blinded
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Independent evaluator, unaware of group allocations

Guo 2005

Methods	*Randomised*: semi-randomised according to the order of admission *Blinding*: patient/care giver were not blinded. Whether assessors were blinded is not reported. *Setting*: in and outpatients of an affiliated hospital, Helongjiang, China *Was study aim clear*: no *Informed consent*: not reported *Ethics approval*: not reported *WHO clinical trial register*: not listed *Follow-up*: 6 months *Intention-to-treat used*: not reported
Participants	*Total number of participants*: 38 patients, mean duration of illness: acupuncture: 11 (2.3) months; control: 10 (3.6) months 7 male and 31 female; acupuncture group: M:F 3:16; control: M:F 4:15 *Mean age*: real acupuncture group = 50 (2.9) yrs (not sure if this is SD); control = 49 (3.4) *Diagnosis*: ACR *Acupuncture-naive participants*: not reported *Excluded*: not reported (did not mention if there were exclusion criteria) *Recruitment source*: not reported. *Previous treatments*: not reported
Interventions	1) *Real*: acupuncture group

Guo 2005 *(Continued)*

	Randomised to this group: 19 (analysed 19) 2) *Control*: Western medication group (amitriptyline, tricyclic antidepressant, start from 10 mg, increased by 10 mg every 10 days until 30 mg, dividing dose into 2 and taking them at 2 different times of the day, 30 days 1 course) Randomised to this group: 19 (analysed 19) *Co-interventions*: not reported See STRICTA table for treatment details (Appendix 10)
Outcomes	*Primary outcome*: 1) Pain; visual analogue scale (VAS), did not specify either 1 to 10 or 0 to 100 range *Secondary outcome*: 2) Number of tender points, did not specify details *Outcome measure results*: Symptoms and signs-free, no tender points; acupuncture 9; control: 3 Significantly improved: VAS and tender points both reduced by or over 50%; most symptoms and signs resolved; 5:2 Improved: VAS and tender points both reduced by 25% to 50%; some improvement in S/S; 4:8 No effect: VAS and tender points both reduced < 25%, no changes in S/S; 1:6 *Withdrawals/drop-outs*: no reported but based on data there were none *Complications/adverse events*: not reported *Data extraction method*: data were extracted from published paper table 2
Notes	*Other info*: we could not contact the lead author to clarify missing information *Refunded costs to participants*: not reported *Funding*: not reported *Language*: Chinese *Publication*: full paper

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	RCT, but no other information
Allocation concealment (selection bias)	High risk	Semi-randomised according to the order of admission
Incomplete outcome data (attrition bias) All outcomes	Low risk	No drop-out reported. According to the data provided, all participants were included in the analysis.
Selective reporting (reporting bias)	Unclear risk	Not listed on WHO clinical trials register

Guo 2005 *(Continued)*

Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	Not reported
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Not reported

Harris 2005

Methods	*Randomised*: computer-generated random numbers in a 4-block design. Concealed in an opaque envelope and given to the acupuncturist 1 day before treatment. *Blinding*: participants blindfolded with a non-blinded research assistant present during the treatments to monitor and ensure treatment integrity. Outcome assessors were blinded to treatment allocation. Care givers knew the allocation groups and the hypothesis. *Setting*: Georgetown University, Washington DC *Was study aim clear*: yes *Informed consent*: verbal and written *Ethics approval*: Institutional Review Board *WHO clinical trial register*: listed on site and outcomes as per listing *Follow-up*: none *Intention-to-treat*: yes
Participants	*Total number of participants*: 114 participants, mean duration of illness (years): T/S = 5.50 years (3.71), T/O = 5.26 years (4.83), N/S = 5.17 years (4.24), N/O = 5.77 years (4.10) 8 male and 106 female *Mean age*: T/S 46.0 (10.1), T/O 44.5 (10.9), N/S 51.3 (10.0), N/O 48.1 (10.9) *Diagnosis*: ACR *Acupuncture-naive participants*: yes *Excluded*: previous acupuncture treatments including sufficient knowledge that would prevent blinding, bleeding diathesis, autoimmune or inflammatory disease, daily narcotic analgesic use or a history of substance abuse, contraindication to use of acetaminophen or ibuprofen, in other clinical studies, pregnancy or lactation, receiving disability payment or litigation related to fibromyalgia *Recruitment source*: the Washington DC metropolitan area using newspaper, periodicals and screened by telephone *Previous treatments*: not reported
Interventions	1) *Real*: traditional acupuncture (T/S) with stimulation Randomised to this group: 29 2) *Control*: traditional acupuncture (T/O) without stimulation Randomised to this group: 30

Harris 2005 *(Continued)*

	3) *Control*: non-traditional acupuncture (N/S) with stimulation, needles at same depth and stimulation as T/S group. Needles were placed in sites not believed to effective in Traditional Chinese Medicine based acupuncture Randomised to this group: 28 4) *Control*: non-traditional acupuncture (N/O) without stimulation, in non-traditional sites Randomised to this group: 27 (Each group received treatment once per week for 3 weeks, then twice per week for 3 weeks, then 3 times per week for 3 weeks (total 18 treatments). Between each treatment, there was a 2-week washout period) *Minimum number of treatments needed*: not reported *Co-interventions*: participants were allowed to continue normal treatments including antidepressants. They were not allowed to make any changes during the trial and not to seek acupuncture outside of the trial. See STRICTA table for treatment details (Appendix 10)
Outcomes	*Primary outcomes*: 1) Pain: numeric rating scale, 101-point, range from 0 to 100 points in 5-point increments, 0 = no pain to 100 = worst pain imaginable (assessed before and week 3, 4 to 5, 8, 9 to 10, 13, 14 to 15) 2) Function: Short-Form 36, score ranges from 0 to 100 with higher scores indicating better function (assessed before and week 4 to 5, 9 to 10, 14 to 15) *Secondary outcomes*: 3) Fatigue: Multi-Dimensional Fatigue Inventory questionnaire, scores range from 4 to 20 with larger scores indicating more fatigue (assessed before and week 4 to 5, 9 to 10, 14 to 15) 4) Blinding: participants were asked in week 4 whether they could determine which treatment arm they were in (A = acupuncture, B = placebo and C = could not tell) *Outcome measure results*: "Clinically significant improvements in pain were observed in 25% to 35% of subjects". "Blinding assessment indicated that participants remained blinded to treatment at week 4 (P = 0.259)". *Withdrawals/drop-outs*: 38 (T/S = 7, T/O = 11, N/S = 8, N/O = 12) *Complications/adverse events*: not reported *Data extraction method*: data were extracted from the published paper using Table 2. We selected T/S and N/O data to represent real and sham acupuncture. For comparing different acupuncture styles we choose T/S versus T/O.
Notes	*Other info*: contact was made with lead author who confirmed details of drop-outs and location of trial *Refunded costs to participants*: not reported *Funding*: NCCAM *Language*: English *Publication*: full paper

Risk of bias

Bias	Authors' judgement	Support for judgement

Harris 2005 *(Continued)*

Random sequence generation (selection bias)	Low risk	Computer-generated
Allocation concealment (selection bias)	Low risk	Random numbers in a 4-block design. Concealed in an opaque envelope and given to the acupuncturist 1 day before treatment.
Incomplete outcome data (attrition bias) All outcomes	Low risk	All participants including those who dropped out from the study were included in the data analysis. The number of and reasons for drop-out were comparable among the groups.
Selective reporting (reporting bias)	Low risk	All outcomes reported, as per WHO clinical trials register
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Used acupuncture-naive participants, other participants not present at clinic during treatment, blindfolded during treatment. Care giver not blinded. Non-blinded research assistant present during all treatments to ensure treatment integrity. Blinding of allocation groups was tested at week 3 with no significant differences noted.
Blinding of outcome assessment (detection bias) All outcomes	Low risk	All evaluators blinded to treatment allocation

Harris 2008

Methods	*Randomised*: random number generator used (blocks of 4 with 2 acupuncture and 2 sham) *Blinding*: participants blindfolded during treatments. All assessors were blinded to treatment assignments. *Setting*: University of Michigan, USA *Was study aim clear*: yes *Informed consent*: written and informed *Follow-up*: none, only for term of treatment *Ethics approval*: University of Michigan Institutional Review Board *WHO clinical trial register*: not listed and confirmed by author *Intention-to-treat*: yes, all subjects completed trial
Participants	*Total number of participants*: 10 participants, duration of fibromyalgia for > 1 year 0 male (acupuncture and control) and 10 female *Mean age*: both acupuncture and control combined mean 48 SD 15 years *Diagnosis*: ACR 1990 criteria *Acupuncture-naive participants*: yes *Excluded*: as per Harris 2005 study *Recruitment source*: fibromyalgia subject registry at the University of Michigan Chronic Pain and Fatigue Center

Harris 2008 *(Continued)*

	Previous treatments:
Interventions	1) *Real*: acupuncture Randomised to this group: 6 2) *Control*: non skin-penetrating acupuncture (Sherman 2002) Randomised to this group: 4 *Minimum number of treatments needed*: 9 out of 9 *Co-intervention*: none See STRICTA table for treatment details (Appendix 10)
Outcomes	*Primary outcomes*: 1) Pain: VAS subset of Short-Form McGill Pain Questionnaire (SF-MPQ) Assessments: at baseline and end of treatment *Outcome measure results*: clinical pain improved from pre- to post-treatment according to SF-MPQ rating of the sensory dimensions of pain (mean difference in clinical pain rating 3.50 (SD 4.70); P = 0.043) SF-MPQ sensory score baseline mean (SD) = 12.3 (4.35) SF-MPQ sensory score end of treatment mean (SD) = 8.80 (5.61) *Withdrawals/drop-outs*: no drop-outs *Complications/adverse events*: no adverse events Author stated "actually the primary outcome for this study was neuroimaging changes for TA and SA. Clinical pain was never a primary outcome, it was only used as a covariate". *Data extraction method*: data for pain was provided by the author directly
Notes	*Other info*: part of an ongoing study; results for this study have not been published anywhere else. Missing details from the study were confirmed by the lead author via e-mail. They included details of randomisation, blinding, whether acupuncture-naive, score baseline/end of treatment/drop-outs and data. The lead author confirmed that this is not a subset of the Harris 2005 study. *Funding*: US Department of Army grant and NIH/National Centre for Complementary and Alternative Medicine *Refunded costs to participants*: not reported *Language*: English *Publication*: full paper

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Computer-generated
Allocation concealment (selection bias)	Low risk	Random number generator used (blocks of 4, with 2 acupuncture and 2 sham)
Incomplete outcome data (attrition bias)	Low risk	No missing data

Harris 2008 *(Continued)*

All outcomes		
Selective reporting (reporting bias)	Unclear risk	Not listed on WHO clinical trials register
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Used acupuncture-naive participants, participants blindfolded, care giver was not blinded
Blinding of outcome assessment (detection bias) All outcomes	Low risk	All assessments were blinded

Harris 2009

Methods	*Randomised*: random number generator used (blocks of 4 with 2 acupuncture and 2 sham) *Blinding*: participants blindfolded during treatments. All assessors were blinded to treatment assignments. *Setting*: University of Michigan, USA *Was study aim clear*: yes *Informed consent*: written and informed *Follow-up*: none, only for term of treatment *Ethics approval*: University of Michigan Institutional Review Board *WHO clinical trial register*: not listed and confirmed by author *Intention-to-treat*: yes, all subjects completed trial
Participants	*Total number of participants*: 20 participants, duration of fibromyalgia > 1 year 0 male (acupuncture and control) and 20 female *Mean age*: both acupuncture and control combined mean 44.3 SD 13.6 years *Diagnosis*: ACR 1990 criteria *Acupuncture-naive participants*: yes *Excluded*: as per Harris 2005 study *Recruitment source*: fibromyalgia subject registry at University of Michigan *Previous treatments*: not reported
Interventions	1) *Real*: acupuncture (TA) *Randomised to this group*: 10 2) *Control*: non skin-penetrating acupuncture (SA) (Sherman 2002) *Randomised to this group*: 10 *Minimum number of treatments needed*: 9 out of 9 *Co-intervention*: medication (agreed not to change)

Harris 2009 *(Continued)*

	See STRICTA table for treatment details (Appendix 10)
Outcomes	*Primary outcomes*: 1) *Pain*: McGill Pain Questionnaire (SF-MPQ) *Assessments*: st baseline and end of treatment *Outcome measure results*: "significant reductions in pain were observed for the entire cohort for the total score SF-MPQ" Total: mean difference (SD) treatment - baseline: -3.45 (7.39); P = 0.05 SF-MPQ Sensory Score: mean (SD): -2.65 (5.98) P = 0.06 SF-MPQ Affective Score: mean (SD): -0.80 (2.25) P = 0.13 Both TA and SA resulted in clinically meaningful reductions in pain (SF-MPQ total score mean difference (SD): TA -4.00 (6.72); SA -2.90 (8.33) 2) *Assessment of masking*: Participants had to guess which group they belonged to after the first PET scan. Overall the 2 distributions were not statistically different: $Chi^2 = 0.88$, P = 0.65 *Withdrawals/drop-outs*: no drop-outs *Complications/adverse events*: no adverse events Author stated "actually the primary outcome for this study was neuroimaging changes for TA and SA. Clinical pain was never a primary outcome, it was only used as a covariate". *Data extraction method*: data were provided by the author. The author noted that "actually in this manuscript (Harris 2009) we did not analyse real versus sham acupuncture groups. We combined both groups together in this analysis".
Notes	*Other info*: part of an ongoing study. Details of study were confirmed by the author via e-mail: drop-outs/adverse events and data. The author confirmed that this is not a subset study of Harris 2005. *Funding*: US Department of Army grant and NIH/National Centre for Complementary and Alternative Medicine *Refunded costs to participants*: not reported *Language*: English *Publication*: full paper

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Computer-generated
Allocation concealment (selection bias)	Low risk	Random number generator used (blocks of 4, with 2 acupuncture and 2 sham)
Incomplete outcome data (attrition bias) All outcomes	Low risk	No missing data

Harris 2009 *(Continued)*

Selective reporting (reporting bias)	Unclear risk	Not listed on WHO clinical trials register
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Used acupuncture-naive participants, participants blindfolded, care giver was not blinded. Participants had to guess which group they belonged to after first PET scan. Overall the 2 distributions were not statistically different.
Blinding of outcome assessment (detection bias) All outcomes	Low risk	All assessments were blinded

Itoh 2010

Methods	*Randomised*: randomly assigned with a computerised randomisation program (SAMPSIZE V2.0, Blackwell Science Ltd, UK), permutated block randomisation to either group *Blinding*: outcome assessors were blinded to treatment assignments *Setting*: Acupuncture and Moxibustion Center, Meiji University of Integrative Medicine, Kyoto, Japan *Was study aim clear*: yes *Informed consent*: written and informed *Follow-up*: none, only for term of treatment *Ethics approval*: Ethics Committee of Meiji University of Integrative Medicine *WHO clinical trial register*: not listed and confirmed by author *Intention-to-treat*: no, analysis only of participants that completed study
Participants	*Total number of participants*: 13 participants, duration of fibromyalgia for Group A 3.9 (SD 8.4), Group B 4.4 (SD 2.3) 3 male and 13 female; does not state which group they were allocated to *Mean age*: Group A 45.7 (15.2), Group B 47.3 (13.3) years *Diagnosis*: ACR 1990 criteria *Acupuncture-naive participants*: yes *Excluded*: previous acupuncture, bleeding disorders, autoimmune or inflammatory diseases, participation in other trials, pregnancy or lactation, receiving disability payments or involved in litigation related to fibromyalgia *Recruitment source*: fibromyalgia specialists at hospitals *Previous treatments*: maintain current medication use
Interventions	1) *Real*: acupuncture (TA) Group B, electro- and trigger point acupuncture *Randomised to this group*: 7 2) *Control*: Group A received 5 acupuncture sessions after 5 weeks of weekly or twice weekly clinical examinations only

Itoh 2010 *(Continued)*

	Randomised to this group: 6 *Minimum number of treatments needed*: not reported *Co-intervention*: medications using amitriptyline, SSRIs and SNRIs (agreed not to change) See STRICTA table for treatment details (Appendix 10)
Outcomes	*Primary outcomes*: 1) Pain: VAS 19 cm scale with higher score indicating negative impact 2) Function: Fibromyalgia Impact questionnaire FIQ), 20 items covering physical functioning, work status, depression, anxiety, sleep (rest/morning tiredness), pain, stiffness, fatigue and well-being. Each scored 0 to 10. The higher the combined score the worse the condition is affecting the participant. Full details on scoring can be found in Burckhardt 1991. *Assessments*: before start, week 5 and at end of treatments, week 10 *Outcome measure results*: VAS, Group A remained unchanged until acupuncture treatment started, while Group B decreased by week 5. No differences between groups at baseline (P = 0.566), while at week 5, significant differences in VAS between groups (P = 0.022) and at week 10 no difference (P = 0.252). FIQ, Group A remained unchanged until acupuncture treatment started, while Group B decreased by week 5. No differences between groups at baseline (P = 0.616), while at week 5 significant differences in FIQ between groups (P = 0.026) and at week 10 no difference (P = 0.86). *Withdrawals/drop-outs*: Group A 2, Group B 1, both lost due to lack of response to treatment *Complications/adverse events*: none reported *Data extraction method*: data were provided by the lead author directly
Notes	*Other info*: author was contacted by e-mail and provided data *Funding*: not reported *Refunded costs to participants*: not reported *Language*: English *Publication*: full paper *Results*: see the comparisons

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Computer-generated
Allocation concealment (selection bias)	Low risk	Permutated block randomisation to either group
Incomplete outcome data (attrition bias) All outcomes	High risk	Intention-to-treat not used, 3 drop-outs (1 acupuncture, 2 no treatment groups) due to lack of response to treatment, however drop-out rates were not significantly different between groups
Selective reporting (reporting bias)	Unclear risk	Not listed on WHO clinical trials register

Itoh 2010 *(Continued)*

Blinding of participants and personnel (performance bias) All outcomes	High risk	Used acupuncture-naive participants, however participants at start of treatment would have known which group they belonged to due to study design; care giver was not blinded
Blinding of outcome assessment (detection bias) All outcomes	Low risk	All assessments performed by independent investigator not aware of treatment sequence or treatment received

Martin 2006

Methods	*Randomised*: immediately before first treatment. Opaque envelopes, labelled sequentially. Each contained a 3 x 5 index card, which was printed with the group assignment. Every 4 envelopes contained 2 control and 2 experimental assignments. This was done in blocks of 2 to prevent imbalances in treatment allocation. Envelopes were opened in order. *Blinding*: participants seated in an arrangement that blocked their view to treatment. Outcome assessors blinded to group allocation. Care givers and participants maintained neutral conversion. *Setting*: Mayo Fibromyalgia Treatment Program, Rochester, Minnesota, USA *Was study aim clear*: yes *Informed consent*: verbal and written *Ethics approval*: Mayo Foundation Institutional Review Board *WHO clinical trial register*: not listed and confirmed by author who stated they did not know about it *Follow-up*: 1 and 7 months *Intention-to-treat*: yes
Participants	*Total number of participants*: 50 patients, mean duration of illness (years): not reported 1 male (control group) and 49 female (real and control) *Mean age*: acupuncture 47.9 SD 11.2 years, control 51.7 SD 14.1 years *Diagnosis*: ACR *Acupuncture-naive participants*: yes *Excluded*: prior acupuncture experience, bleeding diathesis, had to be able to understand consent and to be able to fill out the questionnaires *Recruitment source*: referrals to programme from physician after conservative management *Previous treatments*: patients had received conservative management, but this was not described; "many had already used most of the basic treatments for fibromyalgia"
Interventions	1) *Real*: electroacupuncture, used a special table arrangement that did not allow the patient to see what was happening; Randomised to this group: 25 2) *Control*: sham electroacupuncture, setting was same as real group, except needle was attached to plaster and did not break the skin; Randomised to this group: 25

Martin 2006 *(Continued)*

	Minimum number of treatments needed: all patients completed at least 5 treatments *Co-interventions*: 1.5 days of education, counselling and group discussion about symptom management (done before enrolment into study, 4-week wash-out period before start of treatments). No other co-interventions were reported. See STRICTA table for treatment details (Appendix 10)
Outcomes	*Primary outcomes*: 1) Pain: Multidimensional Pain Inventory (MPI), 61-item questionnaire developed for chronic pain. Composed of 13 scales that measure different pain-related aspects. 4 of the questions that related to support from spouse or significant other were excluded, as it was not part of the standard treatment programme. 2) Function: Fibromyalgia Impact Questionnaire (FIQ), 20 items covering physical functioning, work status, depression, anxiety, sleep (rest/morning tiredness), pain, stiffness, fatigue and well-being. Each scored 0 to 10. The higher the combined score the worse the condition is affecting the patient. Full details on scoring can be found in the article by Burckhardt 1991. *Secondary outcomes*: 3) Participants were asked their opinion regarding group assignment *Assessments*: before start, immediately at end of treatment sessions and at 1 and 7 months *Outcome measure results*: FIQ showed significant improvement in the acupuncture group over control acupuncture during study period (P = 0.01), with the greatest difference at the 1 month (P = 0.007). Subscale analysis showed significant group effect for fatigue (P = 0.001) and anxiety (P = 0.003) at 1 month. Other sub-scales showed trends towards improvement but were not statistically significant. MPI group effect showed significant improvement in pain at 1 month (P = 0.03) but effect was lost at the 7-month measure (P = 0.05). Blinding of participants did not exceed chance *Withdrawals/drop-outs*: 1 lost to follow-up *Complications/adverse events*: many participants in both groups experienced feeling tired and/or relaxed after treatment. Mild bruising and soreness was common in acupuncture group. 2 patients experienced mild vasovagal symptoms (1 from each group). 1 patient experienced a pulmonary embolism (believed to be unrelated to the study). *Data extraction method*: data were extracted from published paper table 3 and we used data at the one month after treatment point as per our protocol
Notes	*Other info*: author was contacted by e-mail and confirmed allocation concealment, WHO listing and point locations *Funding*: Mayo Foundation and Mayo Anaesthesia Clinical Research Unit *Refunded costs to participants*: financial compensation provided for parking *Language*: English *Publication*: full paper

Risk of bias

Bias	Authors' judgement	Support for judgement

Martin 2006 *(Continued)*

Random sequence generation (selection bias)	Unclear risk	Random sequence not reported
Allocation concealment (selection bias)	Low risk	Immediately before first treatment. Opaque envelopes, labelled sequentially. Each contained a 3 x 5 index card, which was printed with the group assignment. Every 4 envelopes contained 2 control and 2 experimental assignments. This was done in blocks of 4 to prevent imbalances in treatment allocation. Envelopes were opened in order.
Incomplete outcome data (attrition bias) All outcomes	Low risk	All participants completed outcome measures at the end of treatment; 1 from the control group did not have data for 1 and 7-month follow-ups and was excluded from follow-up analysis. Given this was only 1 participant, this exclusion would have minimal impact on the outcome.
Selective reporting (reporting bias)	Unclear risk	Not listed on the WHO clinical trials register; author stated did not know about it
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Used acupuncture-naive participants, blinded to actual treatment by seated arrangement of protocol, restricted conversation during treatment and use of blinded study co-ordinator for questions. Care giver was not blinded. Group allocation was tested and ability of patients to determine treatment received did not exceed chance.
Blinding of outcome assessment (detection bias) All outcomes	Low risk	All evaluations were obtained from participants by study co-ordinator who was blinded to group allocations

Targino 2008

Methods	*Randomised*: using "a computer-generated random sequence of numbers provided by the Hospitals Informatics Departments. The randomization was conducted by one physician who was not involved with the inclusion or exclusion process." *Blinding*: assessor blind - "participants rated their pain intensity using a VAS. Blinded evaluation of PPT18 and TePsN was carried out by a single physician (HHSK), while blind evaluation of quality of life was conducted by one psychologist (LPMS). Even though the participants knew which group they were in (either the acupuncture treatment group or the standard care group), they were instructed not to communicate this information to the outcome assessors." *Setting*: not reported, but assume it was the Clinics Hospital *Was study aim clear*: yes *Informed consent*: written and informed consent *Follow-up*: 3 months (after randomisation and at the end of the treatment), 6 months, 12 months and 24 months *Ethics approval*: the ethics review committee of the Clinics Hospital *WHO clinical trial register*: listed and outcomes as per listing *Intention-to-treat*: yes, up to 12 months follow-up, but not at 24 months follow-up
Participants	*Total number of participants*: 58 patients, mean duration of pain (months): acupuncture group 118.8 (117.3), control 93.0 (75.25). Did not describe what they meant by pain duration, whether it was fibromyalgia diagnosis or pain. Assume it refers to fibromyalgia. *Gender*: 0 male (acupuncture and control) and 58 female

Targino 2008 *(Continued)*

	Mean age: acupuncture 52.09 SD 10.97 years, control 51.17 SD 11.20 years *Diagnosis*: ACR: "ACR criteria were applied by one of the physicians (HHSK) to confirm the diagnosis prior to the enrolment to the study." *Inclusion*: 20 to 70 yrs old, have to have had pain VAC > 4/10; using an antidepressants at an analgesic dose (12.5 to 75 mg/kg). Author did not specify the name of medication *Acupuncture-naive participants*: no, patients who had acupuncture in the previous 12 months were excluded. Presumably, this is not an important item because sham acupuncture is not used. *Excluded*: patients with "severe psychiatric disease, the presence of neurological deficits, cardiac disease or glaucoma, and treatment with acupuncture within one year prior to the start of the study." *Recruitment source*: "were recruited by physicians from the Clinics Hospital in Sao Paulo. They included doctors practising in the Pain Clinic of the Department of Neurology, those in the Rheumatology Clinic and those in the Division of Physical Medicine of the Institute of Orthopedics and Traumatology." *Previous treatments*: none reported except for current medication
Interventions	1) *Real*: acupuncture + standard care (12.5 to 75 mg of tricyclic antidepressants per day), individualised plus exercise, including "oral instruction to walk for 30 min twice a week at their own pace, to breathe deeply and to perform mental relaxation exercises for another 30 min. They were also told to perform twice-weekly stretching exercises involving the para-spinalis muscles, glutei, hamstrings, ankle plantar flexors and hip flexors." Patients in the acupuncture group always had their sessions performed by the same physician (RAT). *Randomised to this group*: 34 2) *Control*: standard care, tricyclic antidepressant (individualised, ranging from 12.5 to 75 mg/day, most (84.5%) received 50 mg/day) plus exercise. Participants "were seen by a physician at the beginning of the study and during the follow-up visits. No additional visits were scheduled for the controls to compensate for the extra attention being received by patients in the acupuncture treatment group. Compliance with the use of either exercise or antidepressant drugs was based on participants reports during the outcome evaluation interviews." *Randomised to this group*: 24 *Compliance*: 97.1% (33 participants) completed all 20 sessions, with one leaving after 17 sessions due to complete relief from pain *Minimum number of treatments needed*: not reported *Co-intervention*: not reported See STRICTA table for treatment details (Appendix 10)
Outcomes	*Primary outcomes*: 1) Visual analogue scale (VAS) with 0 = no pain and 10 = worst pain experienced 2) Quality of life: SF-36 form. Portuguese version of MOS 36-item short-form health survey (8-items), higher scores indicate better quality of life. *Secondary outcomes*: 3) Number of tender points below 4 kg/cm^2 (TePsN). The lower the number, the less the severity of symptoms. 4) Mean pressure pain threshold value, over the 18 fibromyalgia points (PPT18). The higher the values the less severe the symptoms, measured with algometry (not sure if electronic or manual). *Assessments*: at baseline, 3 months (after randomisation and at the end of the treatment), 6 months, 12 months and 24 months

Targino 2008 *(Continued)*

	Outcome measure results: The 2 groups were comparable at baseline. Also mentioned in the discussion, the usage of medication was not different between the 2 groups. *VAS* showed statistically significant improvement in the acupuncture group at 3 months (P < 0.001, however at 6, 12 and 24 months follow-up, it was not statistically different between the groups (P > 0.05) *SF-36* showed improvement in only 5 sub-scales of the acupuncture group at 3 months (PF, BP, VT, RE, MH). At 6 months the acupuncture group benefit was for only 1 sub-scale (GH) and at 12-month follow-up only 1 sub-scale showed improvement (RP). *TePsN and PPT18* showed improvement in the acupuncture group at 3 and 6 months There was no statistical difference in the scores of the standard care group at any time (P > 0.05) *Withdrawals/drop-outs*: at 24 months, 2 were lost to follow-up in the acupuncture group (follow-up rate 94.1%), 1 in the control group (follow-up rate 95.8%) *Complications/adverse events*: 2 patients in the acupuncture group reported temporary oedema of the left hand at LI4. There were no reported incidences of discomfort, soreness, vasovagal symptoms, bruising or haematoma at time of treatment or the during the follow-up period of 24 months. *Data extraction method*: data were extracted from the published paper using table 2 and medians/ranges were converted by the CMSG statistician. We could not use SF-36 data as there were no available data for converting median/range to mean. We were waiting for details from the author at the time of publication.
Notes	*Other info*: 1 author of our review was in contact with the study author who that advised she had a paper awaiting publication which she provided direct. This was outside of our search at the start of review and provided further data. *Funding*: no funding provided *Refunded costs to participants*: not reported *Language*: English *Publication*: full paper

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Computer-generated random sequence of numbers
Allocation concealment (selection bias)	High risk	Did not use, as study objective was to evaluate the benefit of the addition of acupuncture to a standard course of tricyclic antidepressants and exercise
Incomplete outcome data (attrition bias) All outcomes	Low risk	No drop-out was reported during the treatment or in the first 12 months of follow-up. 3 participants were not contacted at the 24-month follow-up and their data were excluded from analysis at that time. This exclusion will not impact on the outcome at the end of treatment or 12-month follow-up. Furthermore, the number of drop-outs at 24 months was comparable between the 2 groups.
Selective reporting (reporting bias)	Low risk	All outcomes reported as per WHO clinical trials register

Targino 2008 *(Continued)*

Blinding of participants and personnel (performance bias) All outcomes	High risk	Participants were restricted to those who not had acupuncture in the last 12 months; care giver was not blinded
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Outcome assessors were blinded and participants were told not to inform them of their group allocation

ACR: American College of Rheumatology
CMSG: Cochrane Musculoskeletal Group
FIQ: Fibromyalgia Impact Questionnaire
MPI: Multidimensional Pain Inventory
NCCAM: National Centre for Complementary and Alternative Medicine
NIH: National Institutes of Health
N/O: non-traditional acupuncture without stimulation
N/S: non-traditional acupuncture with stimulation
PET: positron emission tomography
RCT: randomised controlled trial
SA: non skin-penetrating acupuncture
SD: standard deviation
SE: standard error
SF-MPQ: Short-Form McGill Pain Questionnaire
SNRI: serotonin–norepinephrine reuptake inhibitor
S/S: symptoms/signs
SSRI: selective serotonin re-uptake inhibitor
STRICTA: Standards for Reporting Interventions in Controlled studies of Acupuncture
TA: acupuncture (real)
T/O: traditional acupuncture without stimulation
T/S: traditional acupuncture with stimulation
VAS: visual analogue scale
WHO: World Health Organization

Characteristics of excluded studies *[ordered by study ID]*

Study	Reason for exclusion
Cao 2003	Article in Chinese. "Randomised" stated but methods not described. Excluded as study had an extra therapy (mobile cupping) in the acupuncture and Western medicine arm that was not included in the control arm of Western medicine (i.e. acupuncture + Western medicine + mobile cupping versus Western medicine).
Cassisi 1994	Article in Italian. "Patients were randomly chosen and divided into three therapeutic groups." Translation by Italian Cochrane Centre confirms article same as Cassisi 1995 and is a case series.
Cassisi 1995	Article in Italian. "Patients were randomly chosen and divided into three therapeutic groups." Translation by Italian Cochrane Centre confirms article is a case series. This study has been quoted in a number of reviews and articles as a RCT but this is incorrect. Contact with one of the authors: the data in this reprint are incorrect and they advise to use the 1994 article.
Chen 2009	Article in Chinese; case series
Collazo Chao 2010	Article in Spanish; not a RCT
Dai 2009	Article in Chinese; case series

Study	Reason for exclusion
Feldman 2001	Conference report. RCT. The publisher and conference organisers were contacted and could not provide details of the whereabouts of the authors. Internet searches were undertaken to try and locate either author without success.
Gong 2010	Article in Chinese. Extra therapy not included in both arms (acupuncture + mind focus versus Western medicine).
Gou 2010	Article in Chinese. Extra therapy not included in both arms (acupuncture + infrared lamp versus Western medicine).
Guan 2005	Article in Chinese. Data unusable as responder only.
Guevara 2007	Conference report. No primary clinical outcomes published.
Guo 2003	Article in Chinese. Data unusable as responder only.
Guo 2005a	Article in Chinese. Data unusable as responder only (although number of tender points reported for baseline).
Harris 2006	Secondary analysis of original article (Harris 2005)
Harris 2007	Data were from before acupuncture treatment (cross-sectional study)
Harris 2007a	Conference report, RCT. Author was contacted and has advised awaiting full journal publication.
Harris 2007b	Conference report, RCT. Author was contacted and has advised awaiting full journal publication.
Jiang 2010	Article in Chinese. Invalid control (acupuncture + cupping + Western medicine versus acupuncture + cupping versus+ Western medicine).
Lautenschlager 1989	Article in German. ACR criteria not met.
Li 2005	Article in Chinese. Data unusable as responder only.
Li 2005a	Article in Chinese. Data unusable as responder only.
Li 2006	Article in Chinese. 'Randomised' stated but methods not described. Excluded as study had an extra therapy (mobile cupping) in the acupuncture and Western medicine arm that was not included in the control arm of Western medicine (acupuncture + Western medicine + mobile cupping versus Western medicine).
Li 2008	Article in Chinese. Did not report any of our primary outcomes measures.
Li 2010	Article in Chinese. Invalid control (acupuncture + moxa versus acupuncture + moxa + Western medicine).
Lui 2002	Article in Chinese. Did not meet ACR criteria.
Sandberg 1999	Swedish study. Not a RCT.
Sandberg 2004	Comparison study. None of the review's primary outcome measures were used.
Sprott 1995	Article in German. Conference report. Author asked that the 1998 study be considered, although this report had more data than the 1998 study.
Sprott 1998	"Randomly subdivided into 3 groups". Data unusable as shows only 'mean' results.

Study	Reason for exclusion
Sprott 2000	Article in German. Unsure how randomised. None of the review's primary outcome measures were used.
Sun 2008	Article in Chinese; case series
Targino 2002	RCT; no quantitative data for analyses
Uhlemann 2001	Article in German. Randomised. Conference report. Author could not be contacted; no quantitative data for analysis.
Wang 2002	Article in Chinese. Data unusable as no SD.
Wang 2004	Article in Chinese. Data unusable as responder only.
Wei 2006	Article in Chinese. Data unusable as responder only.
Wu 2003	Article in Chinese. Data unusable as responder only.
Yao 2006	Article in Chinese. Data unusable as responder only.
Zhang 2001	Article in Chinese. Data unusable as responder only.
Zhou 2003	Article in Chinese. Data unusable as responder only.

ACR: American College of Rheumatology
FIQ: Fibromyalgia Impact Questionnaire
RCT: randomised controlled trial
SD: standard deviation

Characteristics of ongoing studies *[ordered by study ID]*

Vas 2011

Trial name or title	Effects of acupuncture on patients with fibromyalgia: study protocol of a multi-centre randomised controlled trial
Methods	RCT multi-centre study
Participants	156 participants, aged over 17, ACR diagnosis
Interventions	True or sham acupuncture, 9 treatments, once per week
Outcomes	FIQ, Hamilton rating scale for depression, medication use. Follow-up 6 and 12 months
Starting date	October 2010 to December 2013
Contact information	jorgef.vas.sspa@juntadeandalucia.es
Notes	

ACR: American College of Rheumatology
FIQ: Fibromyalgia Impact Questionnaire
RCT: randomised controlled trial

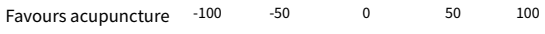
DATA AND ANALYSES

Comparison 1. Acupuncture versus non-acupuncture treatment

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Pain up to 1 month after treatment	1	13	Mean Difference (IV, Random, 95% CI)	-22.4 [-40.98, -3.82]
2 Global well-being: rated by participants up to 1 month after treatment	1	13	Mean Difference (IV, Random, 95% CI)	-15.40 [-25.62, -5.18]
3 Sleep up to 1 month after treatment	1	13	Mean Difference (IV, Random, 95% CI)	-0.40 [-1.01, 0.21]
4 Fatigue up to 1 month after treatment	1	13	Mean Difference (IV, Random, 95% CI)	-1.1 [-1.98, -0.22]
5 Stiffness up to 1 month after treatment	1	13	Mean Difference (IV, Random, 95% CI)	-0.90 [-1.66, -0.14]
6 Adverse events	1	13	Risk Ratio (M-H, Random, 95% CI)	0.0 [0.0, 0.0]
7 Mental well-being up to 1 month after treatment	1	13	Mean Difference (IV, Random, 95% CI)	-0.5 [-1.10, 0.10]

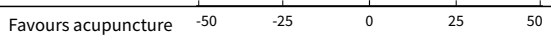
Analysis 1.1. Comparison 1 Acupuncture versus non-acupuncture treatment, Outcome 1 Pain up to 1 month after treatment.

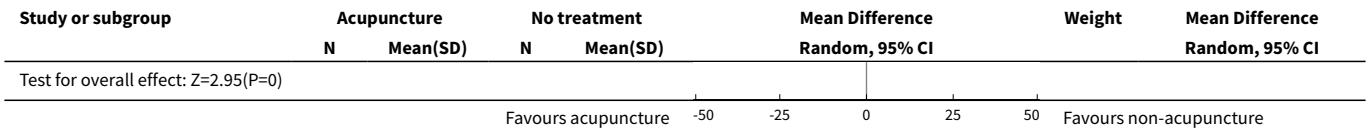
Study or subgroup	Acupuncture N	Acupuncture Mean(SD)	No treatment N	No treatment Mean(SD)	Mean Difference Random, 95% CI	Weight	Mean Difference Random, 95% CI
Itoh 2010	7	47.4 (20.4)	6	69.8 (13.5)		100%	-22.4[-40.98,-3.82]
Total ***	**7**		**6**			**100%**	**-22.4[-40.98,-3.82]**
Heterogeneity: Not applicable							
Test for overall effect: Z=2.36(P=0.02)							



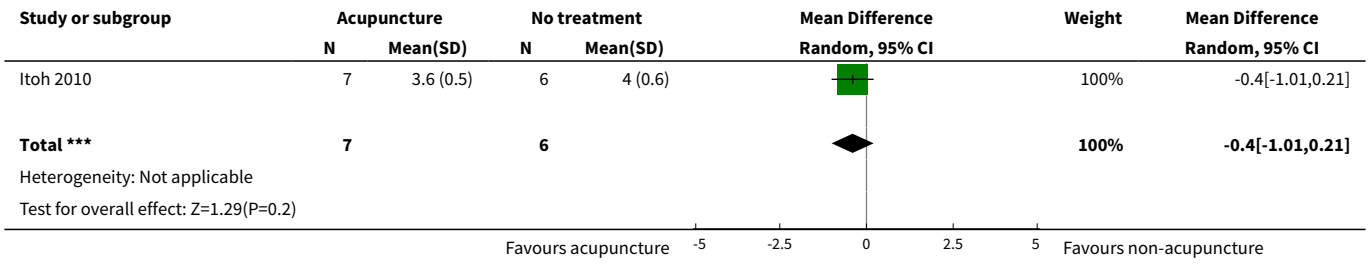
Analysis 1.2. Comparison 1 Acupuncture versus non-acupuncture treatment, Outcome 2 Global well-being: rated by participants up to 1 month after treatment.

Study or subgroup	Acupuncture N	Acupuncture Mean(SD)	No treatment N	No treatment Mean(SD)	Mean Difference Random, 95% CI	Weight	Mean Difference Random, 95% CI
Itoh 2010	7	51.1 (8)	6	66.5 (10.4)		100%	-15.4[-25.62,-5.18]
Total ***	**7**		**6**			**100%**	**-15.4[-25.62,-5.18]**
Heterogeneity: Not applicable							

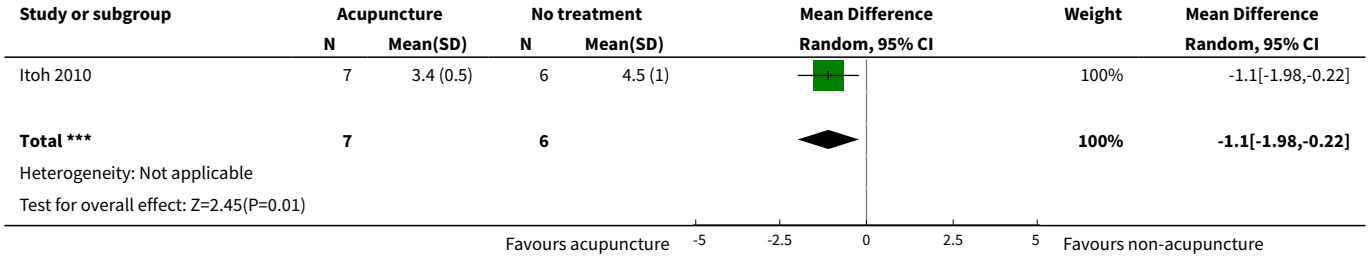




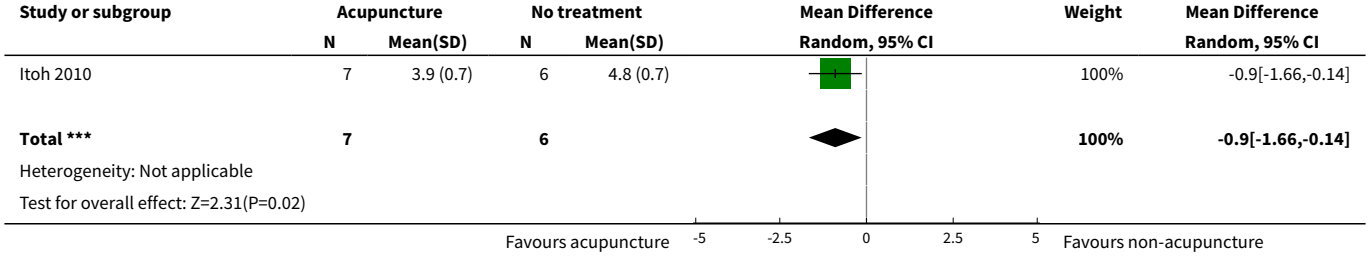
Analysis 1.3. Comparison 1 Acupuncture versus non-acupuncture treatment, Outcome 3 Sleep up to 1 month after treatment.



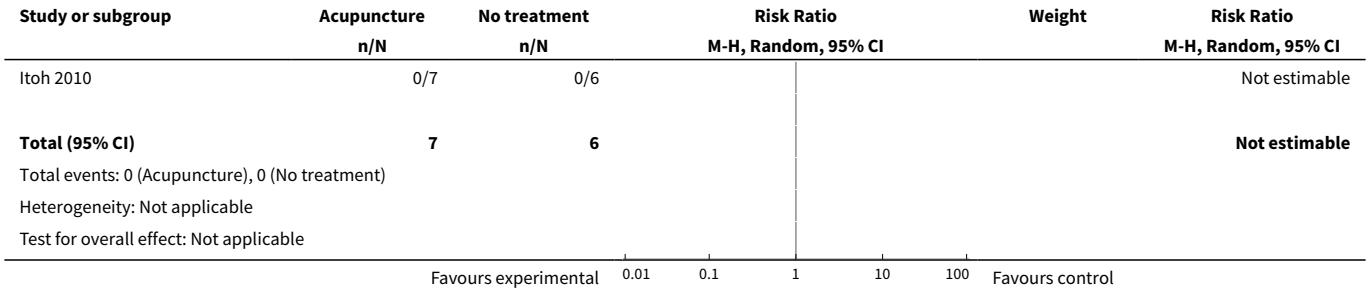
Analysis 1.4. Comparison 1 Acupuncture versus non-acupuncture treatment, Outcome 4 Fatigue up to 1 month after treatment.



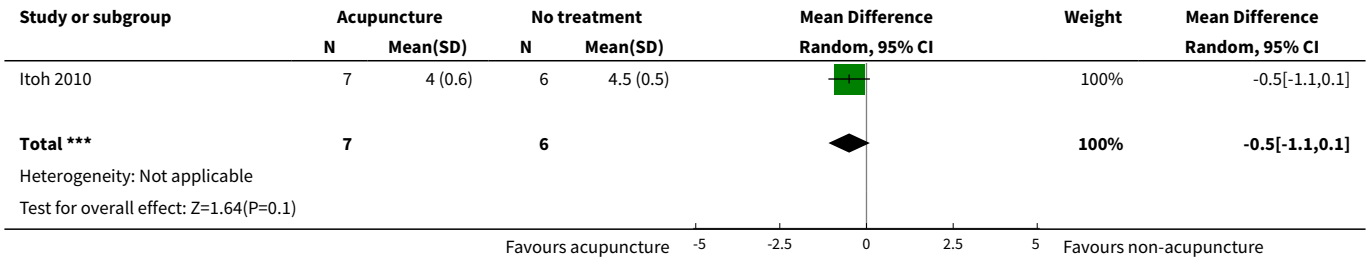
Analysis 1.5. Comparison 1 Acupuncture versus non-acupuncture treatment, Outcome 5 Stiffness up to 1 month after treatment.



Analysis 1.6. Comparison 1 Acupuncture versus non-acupuncture treatment, Outcome 6 Adverse events.



Analysis 1.7. Comparison 1 Acupuncture versus non-acupuncture treatment, Outcome 7 Mental well-being up to 1 month after treatment.



Comparison 2. Acupuncture versus placebo or sham acupuncture

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Pain (subgroup EA & MA) up to 1 month after treatment	6	286	Std. Mean Difference (IV, Random, 95% CI)	-0.14 [-0.53, 0.25]
1.1 Electro-acupuncture	2	104	Std. Mean Difference (IV, Random, 95% CI)	-0.63 [-1.02, -0.23]
1.2 Manual acupuncture	4	182	Std. Mean Difference (IV, Random, 95% CI)	0.14 [-0.17, 0.45]
2 Pain follow-up to 7 months after treatment (subgroup EA vs MA)	2	145	Std. Mean Difference (IV, Random, 95% CI)	-0.12 [-0.52, 0.28]
2.1 Electro-acupuncture	1	49	Std. Mean Difference (IV, Random, 95% CI)	-0.37 [-0.93, 0.20]
2.2 Manual acupuncture	1	96	Std. Mean Difference (IV, Random, 95% CI)	0.05 [-0.41, 0.51]
3 Pain: sham non-invasive acupuncture (not breaking skin) vs sham invasive acupuncture (breaking skin)	6		Std. Mean Difference (IV, Random, 95% CI)	Subtotals only

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
3.1 Sham breaking skin	3	170	Std. Mean Difference (IV, Random, 95% CI)	-0.21 [-0.57, 0.15]
3.2 Sham not breaking skin	4	116	Std. Mean Difference (IV, Random, 95% CI)	0.04 [-0.64, 0.71]
4 Physical function (SF-36)	1	56	Mean Difference (IV, Random, 95% CI)	-5.80 [-10.91, -0.69]
5 Global well-being: rated by participants (subgroup EA vs MA) up to 1 month after treatment	3	200	Std. Mean Difference (IV, Random, 95% CI)	0.29 [-0.44, 1.01]
5.1 Electro-acupuncture	2	104	Std. Mean Difference (IV, Random, 95% CI)	0.65 [0.26, 1.05]
5.2 Manual acupuncture	1	96	Std. Mean Difference (IV, Random, 95% CI)	-0.40 [-0.86, 0.06]
6 Global well-being follow-up to 7 months after treatment (subgroup EA & MA)	2	145	Std. Mean Difference (IV, Random, 95% CI)	-0.03 [-0.87, 0.81]
6.1 Electro-acupuncture	1	49	Std. Mean Difference (IV, Random, 95% CI)	0.41 [-0.15, 0.98]
6.2 Manual acupuncture	1	96	Std. Mean Difference (IV, Random, 95% CI)	-0.45 [-0.91, 0.01]
7 Sleep (subgroup EA & MA) up to 1 month after treatment	3	200	Std. Mean Difference (IV, Random, 95% CI)	0.16 [-0.29, 0.61]
7.1 Electro-acupuncture	2	104	Std. Mean Difference (IV, Random, 95% CI)	0.40 [0.01, 0.79]
7.2 Manual acupuncture	1	96	Std. Mean Difference (IV, Random, 95% CI)	-0.25 [-0.71, 0.21]
8 Sleep follow-up to 7 months after treatment (subgroup EA & MA)	2	145	Std. Mean Difference (IV, Random, 95% CI)	-0.09 [-0.44, 0.26]
8.1 Electro-acupuncture	1	49	Std. Mean Difference (IV, Random, 95% CI)	0.07 [-0.49, 0.63]
8.2 Manual acupuncture	1	96	Std. Mean Difference (IV, Random, 95% CI)	-0.20 [-0.66, 0.26]
9 Fatigue (subgroup EA vs MA) up to 1 month after treatment	3	201	Std. Mean Difference (IV, Random, 95% CI)	-0.10 [-0.81, 0.61]
9.1 Electro-acupuncture	1	49	Std. Mean Difference (IV, Random, 95% CI)	-0.85 [-1.44, -0.27]
9.2 Manual acupuncture	2	152	Std. Mean Difference (IV, Random, 95% CI)	0.26 [-0.08, 0.61]

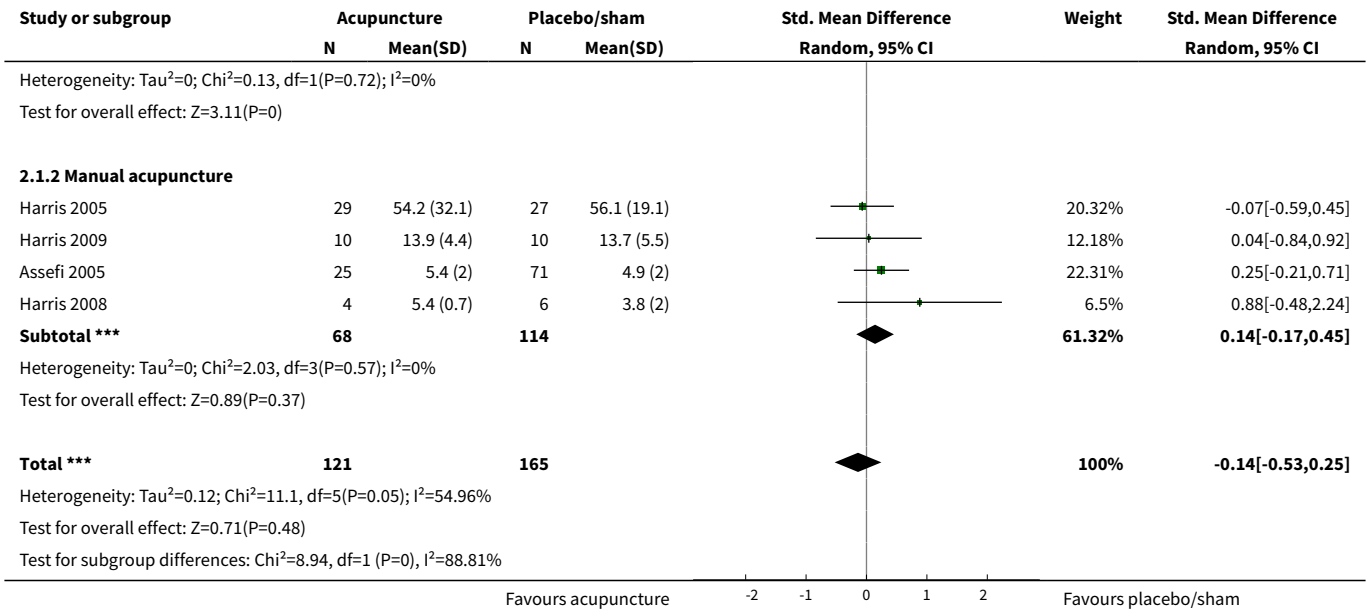
Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
10 Fatigue follow-up to 7 months after treatment (subgroup EA vs MA)	2	145	Std. Mean Difference (IV, Random, 95% CI)	0.04 [-0.52, 0.59]
10.1 Electro-acupuncture	1	49	Std. Mean Difference (IV, Random, 95% CI)	-0.27 [-0.84, 0.29]
10.2 Manual acupuncture	1	96	Std. Mean Difference (IV, Random, 95% CI)	0.30 [-0.16, 0.76]
11 Stiffness up to 1 month after treatment	2	104	Std. Mean Difference (IV, Random, 95% CI)	-0.45 [-0.84, -0.06]
12 Stiffness follow-up to 7 months after treatment	1	49	Mean Difference (IV, Random, 95% CI)	-0.30 [-1.60, 1.00]
13 Adverse events	6	289	Risk Ratio (M-H, Random, 95% CI)	0.44 [0.12, 1.63]
14 Mental well-being up to 1 month after treatment	1	49	Mean Difference (IV, Random, 95% CI)	-1.70 [-3.13, -0.27]
15 Mental well-being follow-up to 7 months	1	49	Mean Difference (IV, Random, 95% CI)	-1.40 [-3.01, 0.21]
16 Analgesic use (number of tablets per week) up to 1 month after treatment	1	55	Mean Difference (IV, Random, 95% CI)	-3.20 [-10.20, 3.80]
17 Analgesic use (number of participants taking analgesics up to 1 month after treatment)	1	80	Risk Ratio (M-H, Random, 95% CI)	0.94 [0.66, 1.32]
18 Tenderness up to 1 month after treatment	1	55	Mean Difference (IV, Random, 95% CI)	0.80 [0.02, 1.58]
18.1 Mean pressure pain threshold (kg/cm^2)	1	55	Mean Difference (IV, Random, 95% CI)	0.80 [0.02, 1.58]
19 Overall well-being: rated by care giver at end of treatment	1	55	Mean Difference (IV, Random, 95% CI)	2.0 [0.81, 3.19]

Analysis 2.1. Comparison 2 Acupuncture versus placebo or sham acupuncture, Outcome 1 Pain (subgroup EA & MA) up to 1 month after treatment.

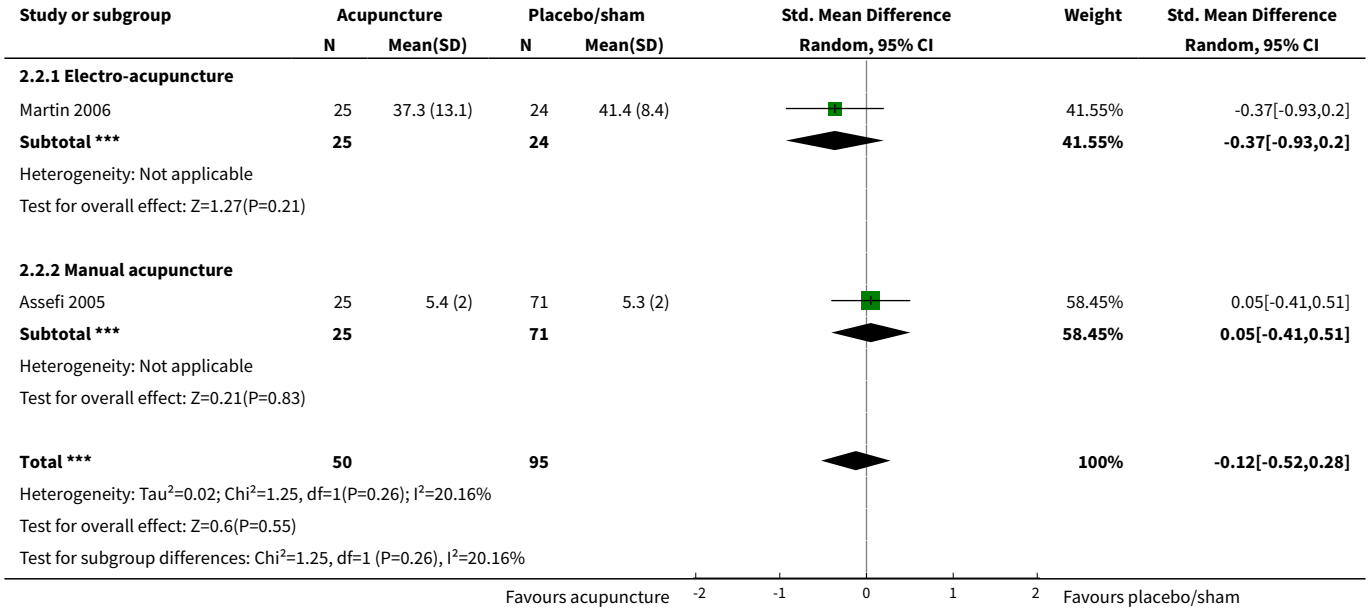
Study or subgroup	Acupuncture N	Acupuncture Mean(SD)	Placebo/sham N	Placebo/sham Mean(SD)	Std. Mean Difference Random, 95% CI	Weight	Std. Mean Difference Random, 95% CI
2.1.1 Electro-acupuncture							
Martin 2006	25	34.2 (11.4)	24	41.6 (9.1)		18.8%	-0.7[-1.28,-0.13]
Deluze 1992	28	39.9 (26.3)	27	53.8 (22.7)		19.89%	-0.56[-1.1,-0.02]
Subtotal ***	**53**		**51**			**38.68%**	**-0.63[-1.02,-0.23]**

Favours acupuncture

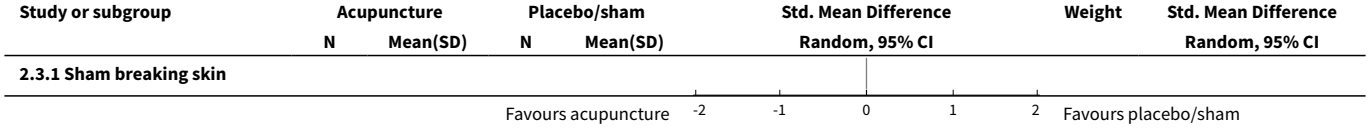
Favours placebo/sham

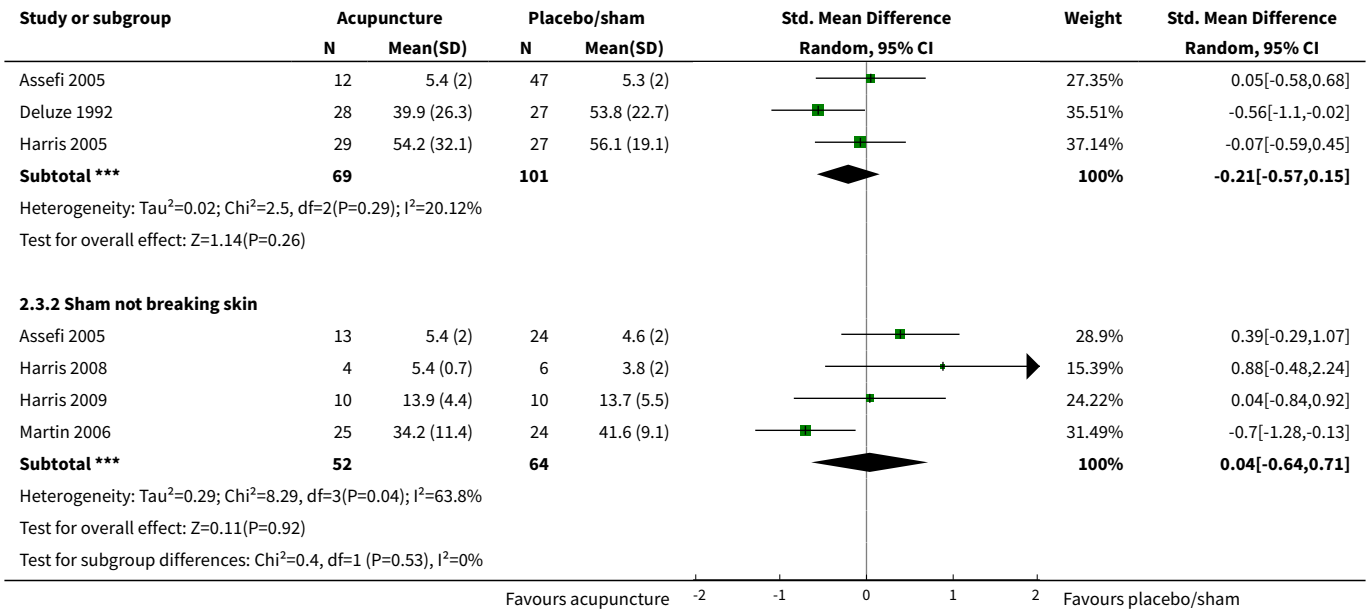


Analysis 2.2. Comparison 2 Acupuncture versus placebo or sham acupuncture, Outcome 2 Pain follow-up to 7 months after treatment (subgroup EA vs MA).

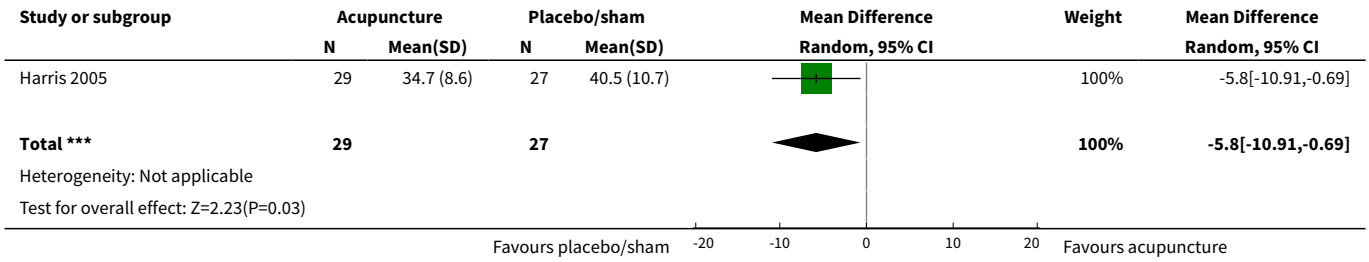


Analysis 2.3. Comparison 2 Acupuncture versus placebo or sham acupuncture, Outcome 3 Pain: sham non-invasive acupuncture (not breaking skin) vs sham invasive acupuncture (breaking skin).

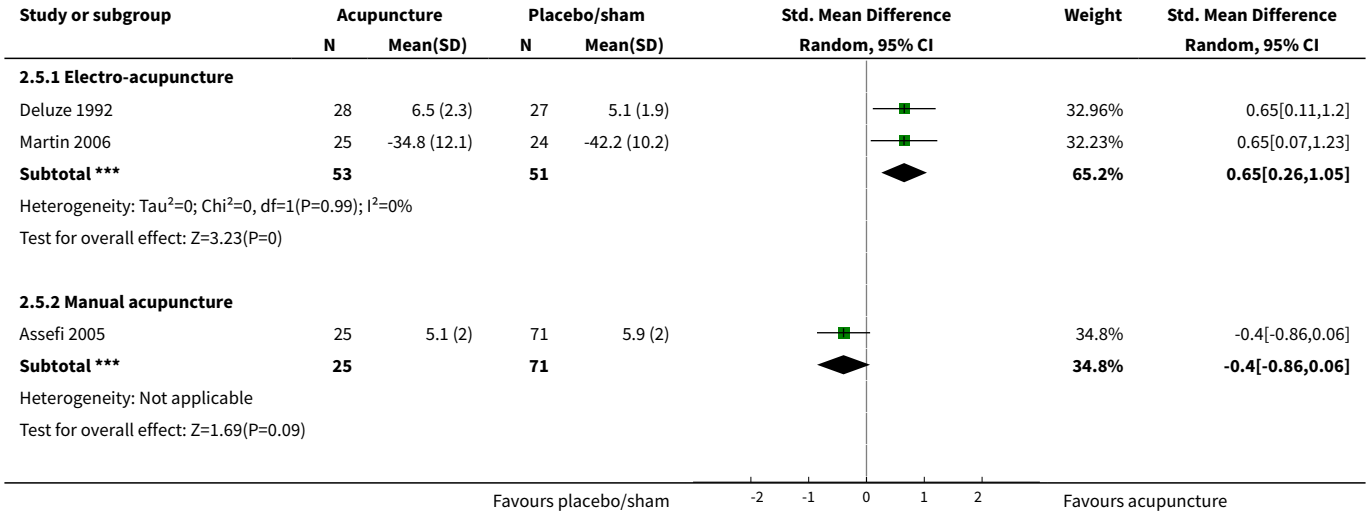


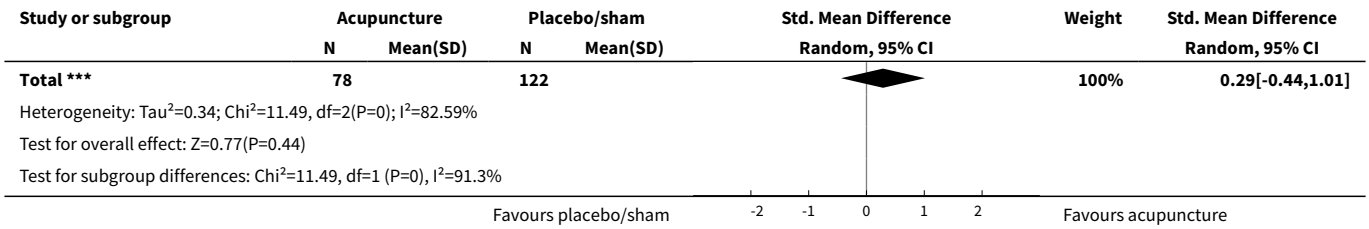


Analysis 2.4. Comparison 2 Acupuncture versus placebo or sham acupuncture, Outcome 4 Physical function (SF-36).

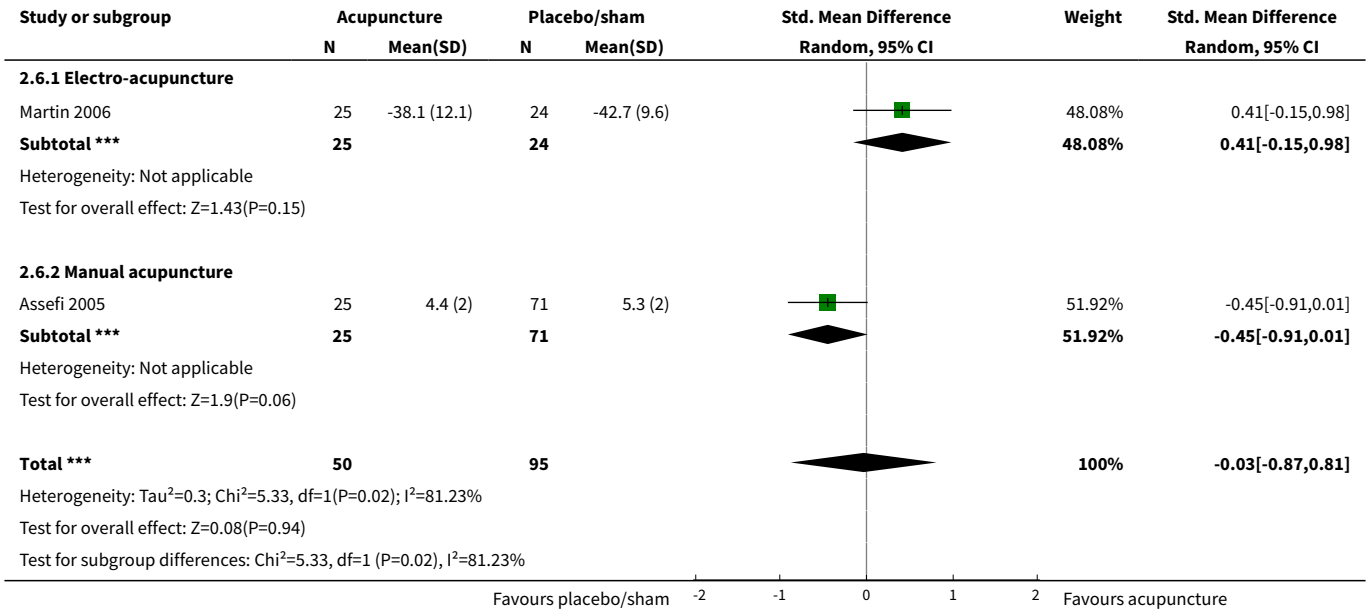


Analysis 2.5. Comparison 2 Acupuncture versus placebo or sham acupuncture, Outcome 5 Global well-being: rated by participants (subgroup EA vs MA) up to 1 month after treatment.

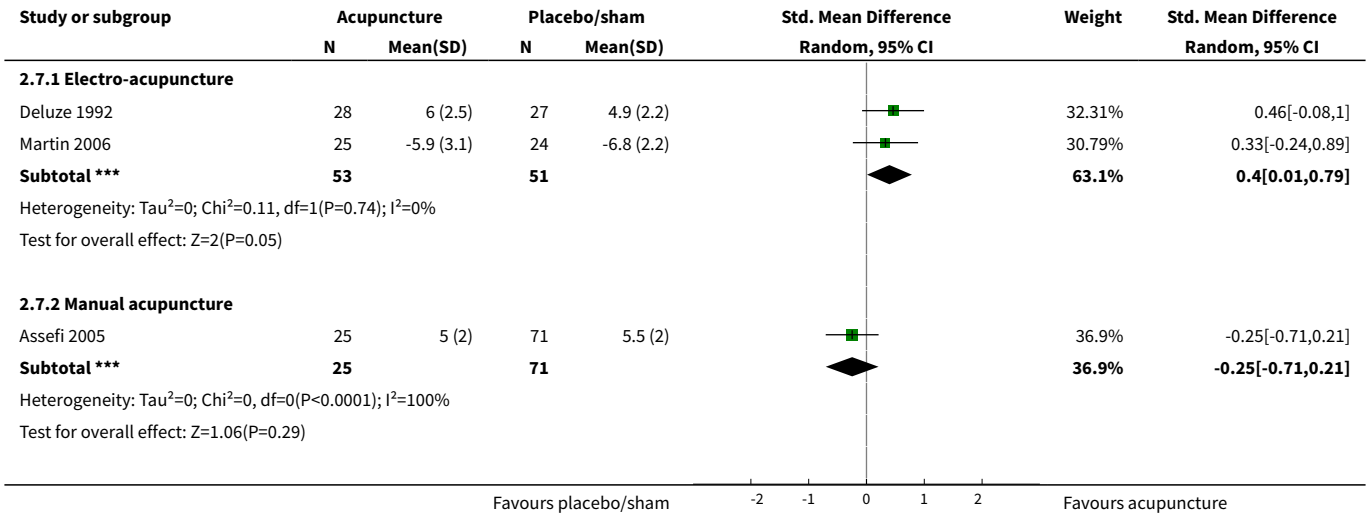


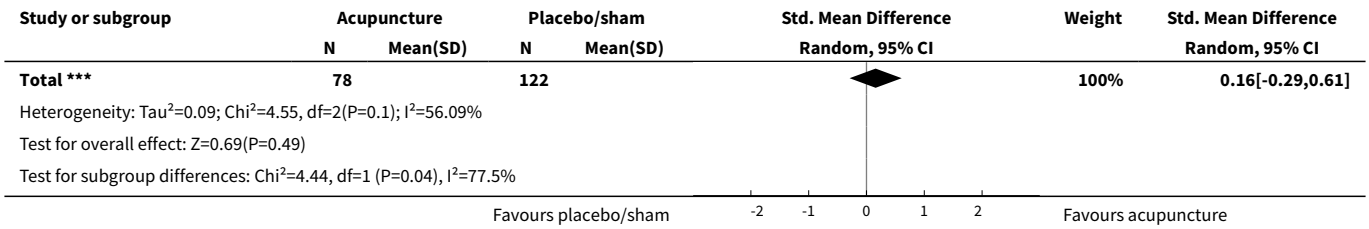


Analysis 2.6. Comparison 2 Acupuncture versus placebo or sham acupuncture, Outcome 6 Global well-being follow-up to 7 months after treatment (subgroup EA & MA).

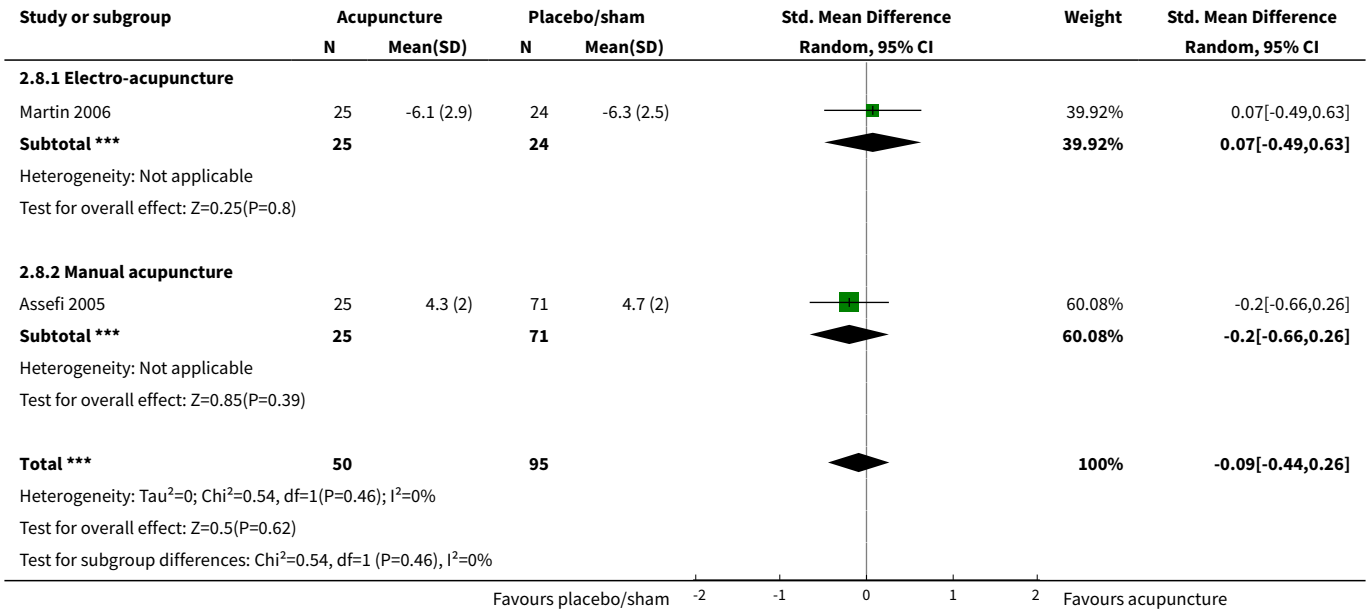


Analysis 2.7. Comparison 2 Acupuncture versus placebo or sham acupuncture, Outcome 7 Sleep (subgroup EA & MA) up to 1 month after treatment.

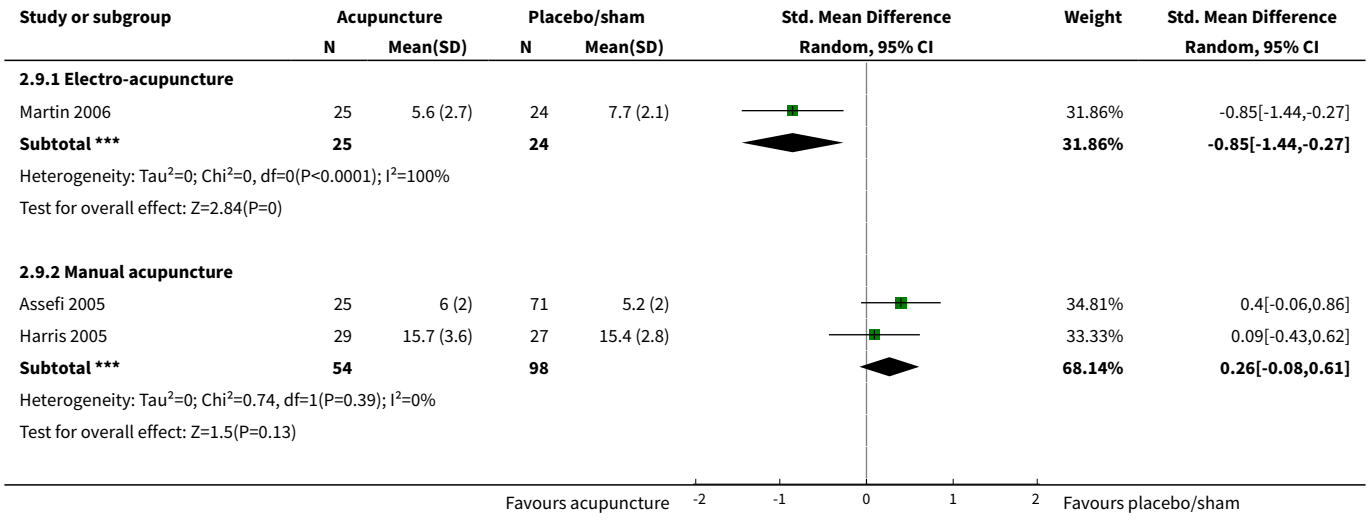


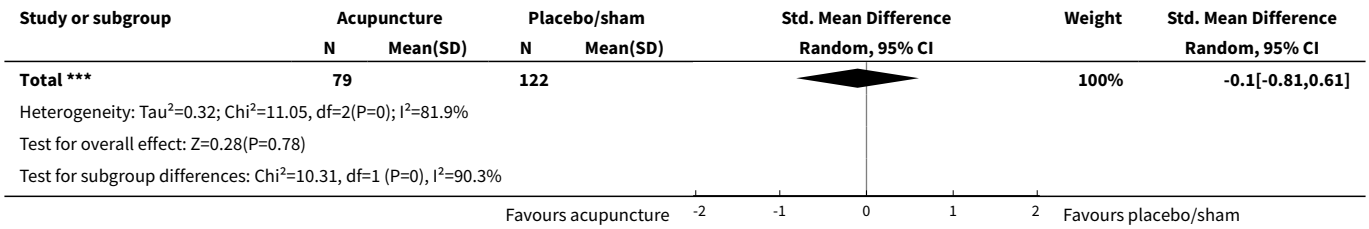


Analysis 2.8. Comparison 2 Acupuncture versus placebo or sham acupuncture, Outcome 8 Sleep follow-up to 7 months after treatment (subgroup EA & MA).

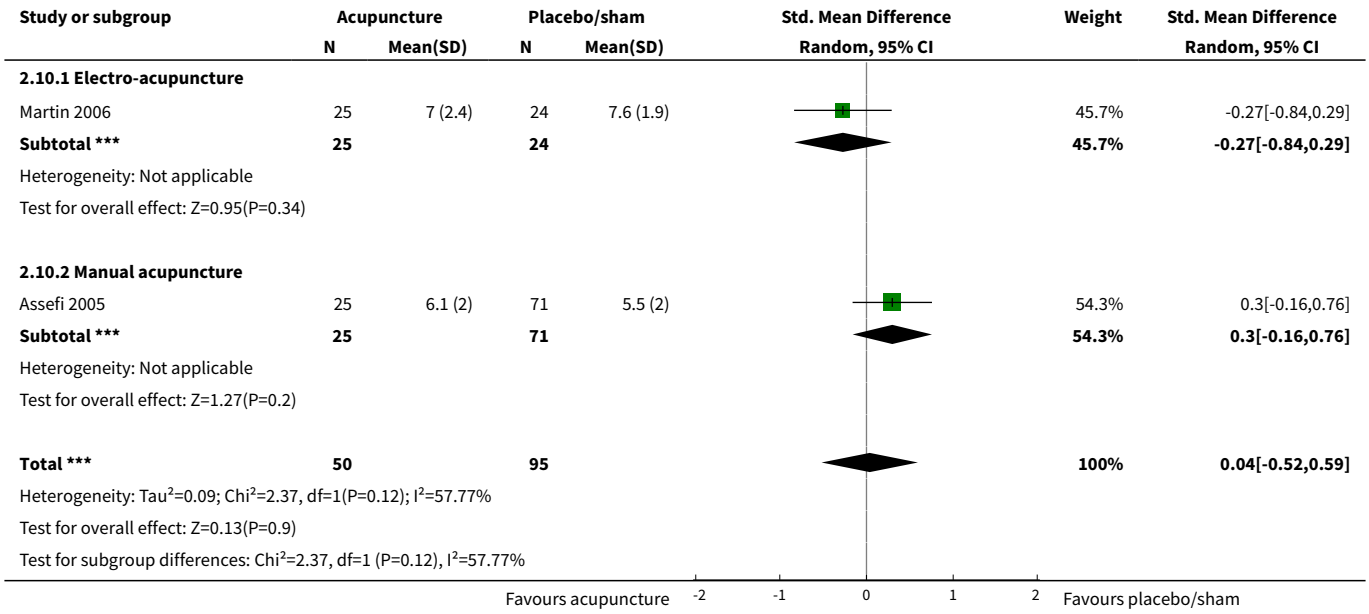


Analysis 2.9. Comparison 2 Acupuncture versus placebo or sham acupuncture, Outcome 9 Fatigue (subgroup EA vs MA) up to 1 month after treatment.

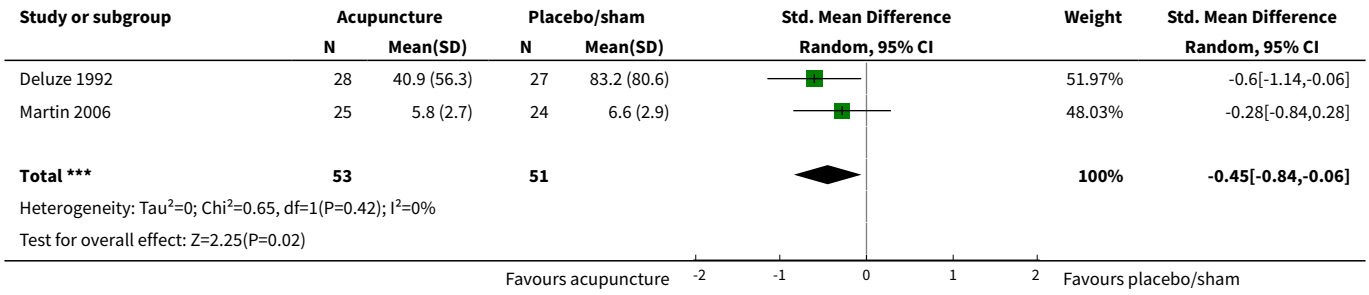




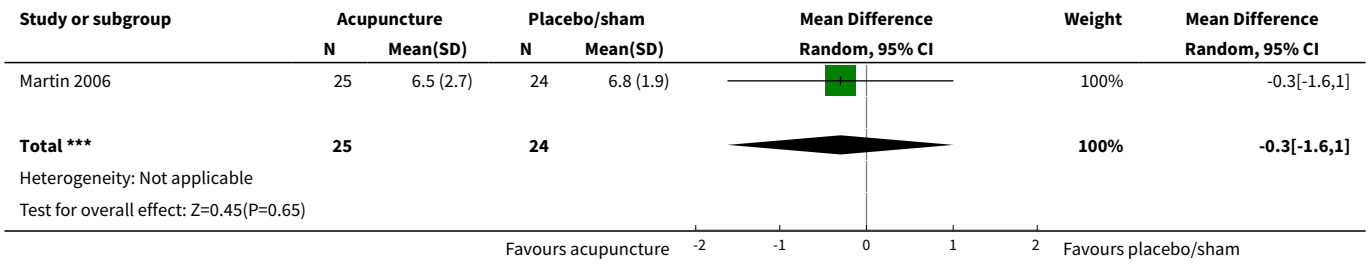
Analysis 2.10. Comparison 2 Acupuncture versus placebo or sham acupuncture, Outcome 10 Fatigue follow-up to 7 months after treatment (subgroup EA vs MA).



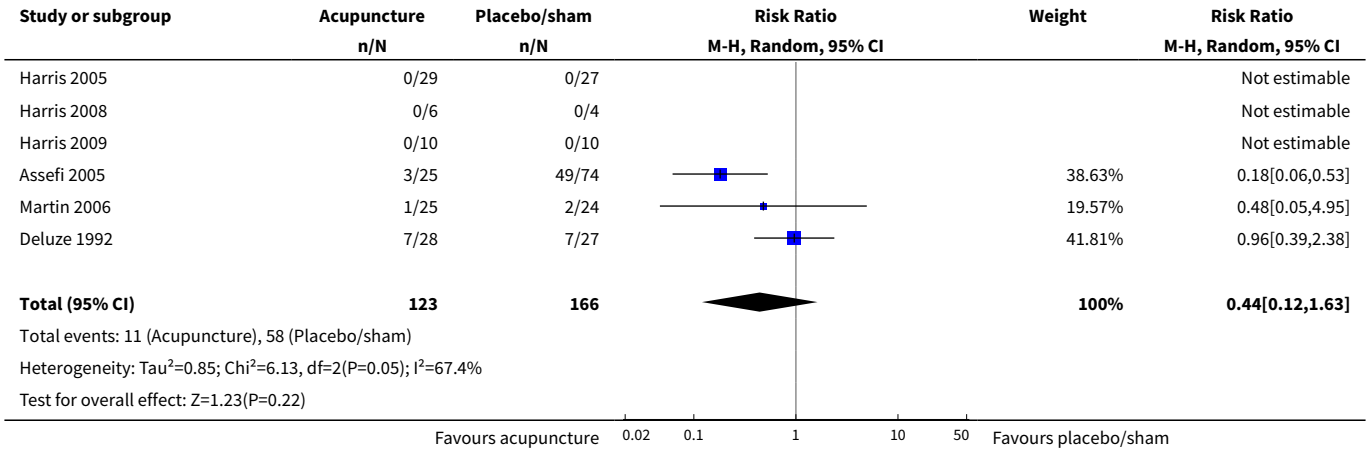
Analysis 2.11. Comparison 2 Acupuncture versus placebo or sham acupuncture, Outcome 11 Stiffness up to 1 month after treatment.



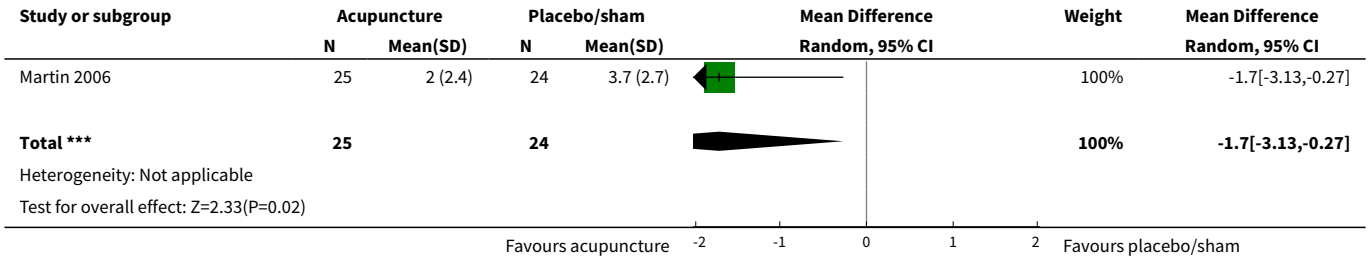
Analysis 2.12. Comparison 2 Acupuncture versus placebo or sham acupuncture, Outcome 12 Stiffness follow-up to 7 months after treatment.



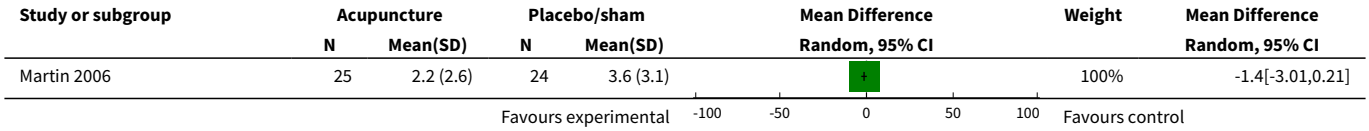
Analysis 2.13. Comparison 2 Acupuncture versus placebo or sham acupuncture, Outcome 13 Adverse events.

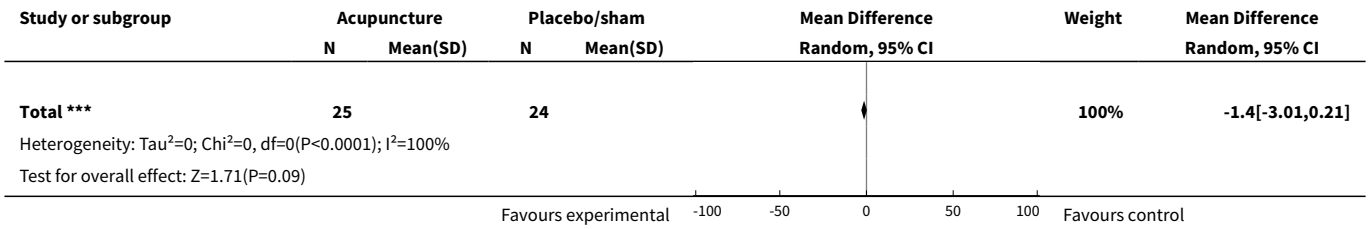


Analysis 2.14. Comparison 2 Acupuncture versus placebo or sham acupuncture, Outcome 14 Mental well-being up to 1 month after treatment.

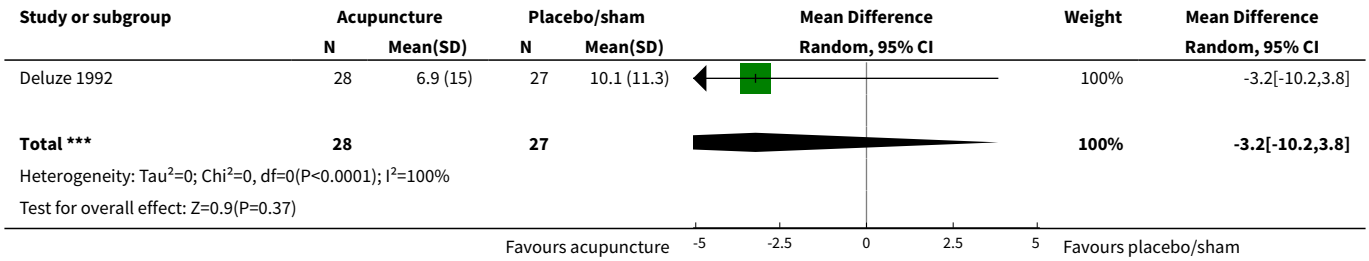


Analysis 2.15. Comparison 2 Acupuncture versus placebo or sham acupuncture, Outcome 15 Mental well-being follow-up to 7 months.

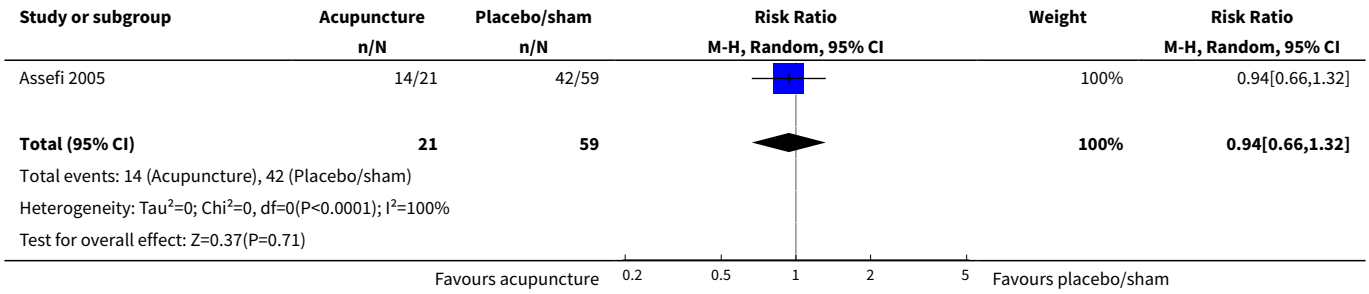




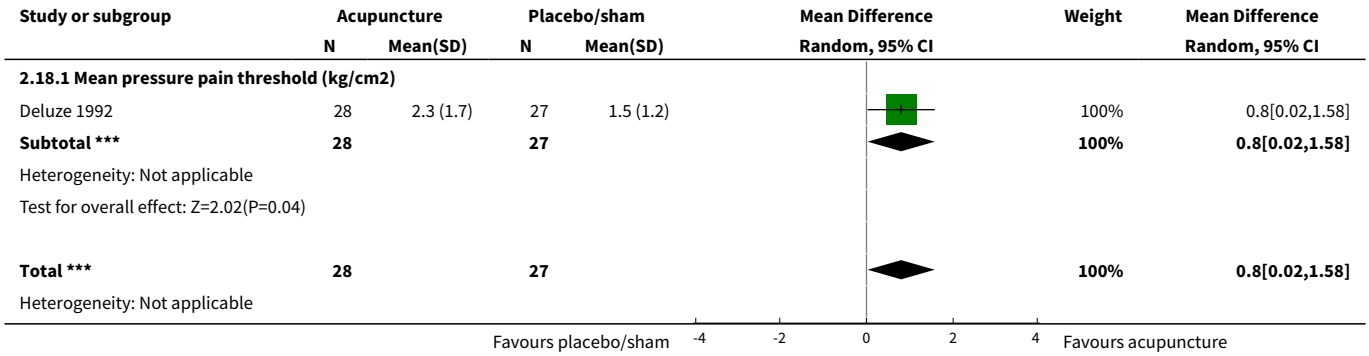
Analysis 2.16. Comparison 2 Acupuncture versus placebo or sham acupuncture, Outcome 16 Analgesic use (number of tablets per week) up to 1 month after treatment.

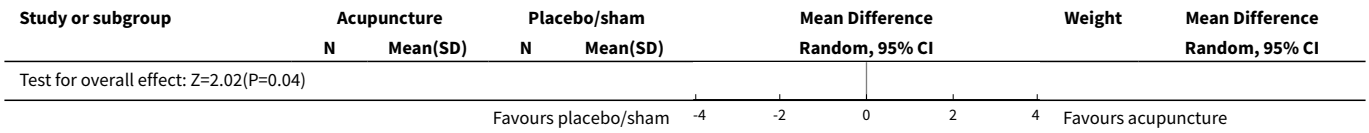


Analysis 2.17. Comparison 2 Acupuncture versus placebo or sham acupuncture, Outcome 17 Analgesic use (number of participants taking analgesics up to 1 month after treatment).

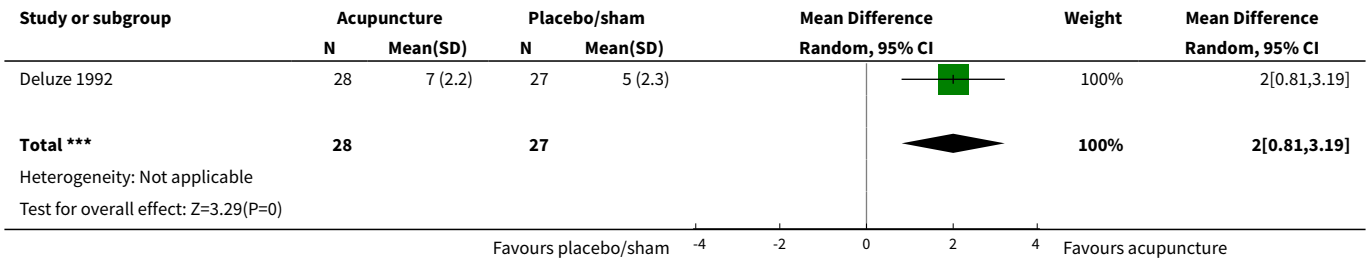


Analysis 2.18. Comparison 2 Acupuncture versus placebo or sham acupuncture, Outcome 18 Tenderness up to 1 month after treatment.





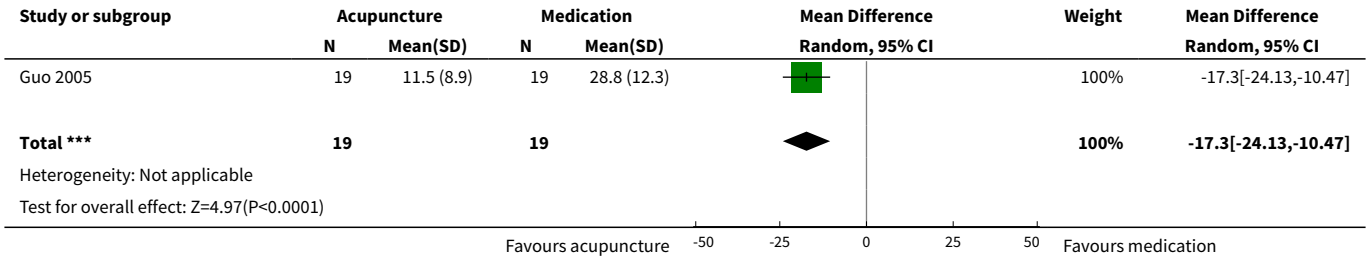
Analysis 2.19. Comparison 2 Acupuncture versus placebo or sham acupuncture, Outcome 19 Overall well-being: rated by care giver at end of treatment.



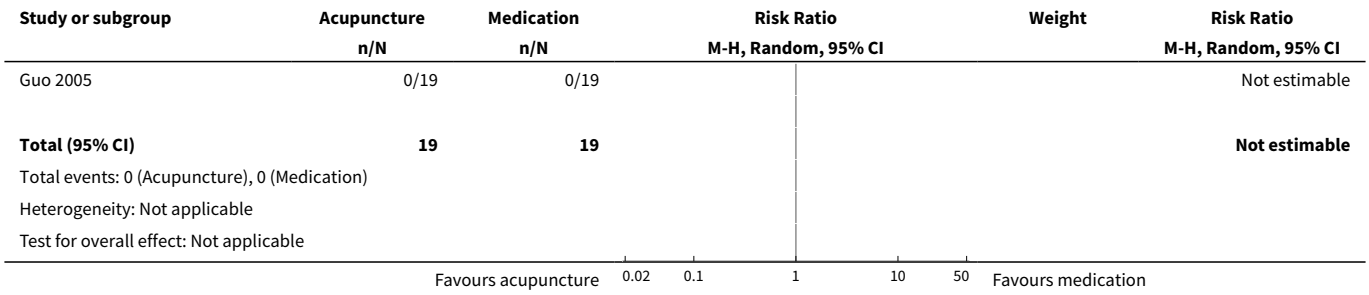
Comparison 3. Acupuncture versus medication

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Pain up to 1 month after treatment	1	38	Mean Difference (IV, Random, 95% CI)	-17.3 [-24.13, -10.47]
2 Adverse events	1	38	Risk Ratio (M-H, Random, 95% CI)	0.0 [0.0, 0.0]
3 Tenderness up to 1 month after treatment	1	38	Mean Difference (IV, Random, 95% CI)	-4.00 [-6.73, -1.27]
3.1 Number of tender points	1	38	Mean Difference (IV, Random, 95% CI)	-4.00 [-6.73, -1.27]

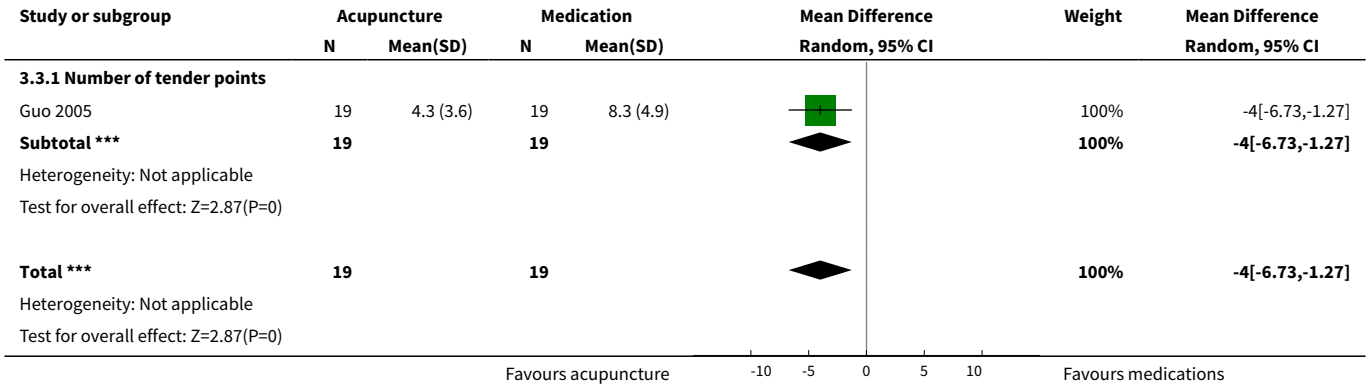
Analysis 3.1. Comparison 3 Acupuncture versus medication, Outcome 1 Pain up to 1 month after treatment.



Analysis 3.2. Comparison 3 Acupuncture versus medication, Outcome 2 Adverse events.



Analysis 3.3. Comparison 3 Acupuncture versus medication, Outcome 3 Tenderness up to 1 month after treatment.

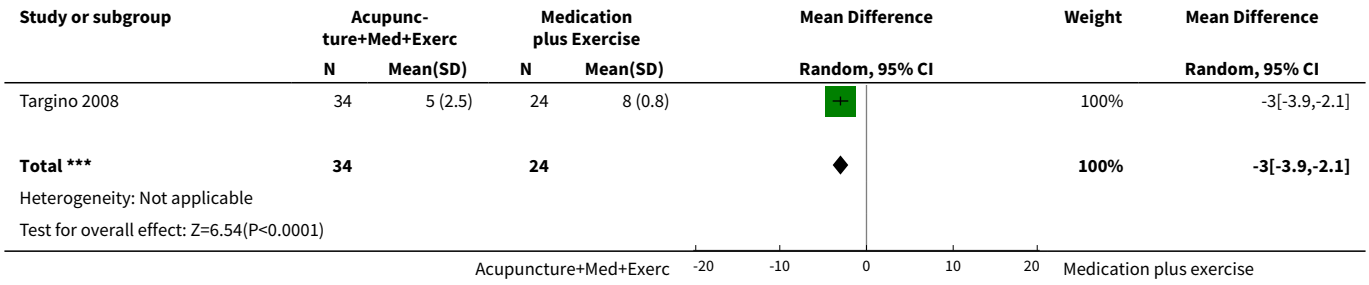


Comparison 4. Acupuncture as an adjunct therapy

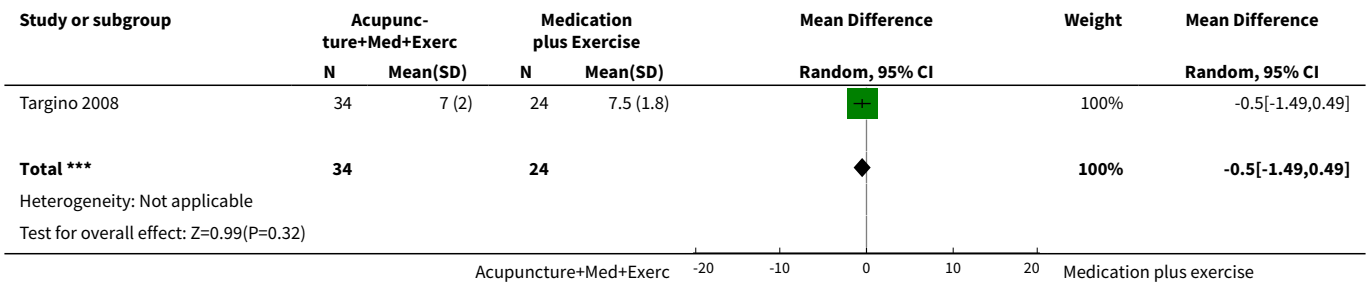
Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Pain up to 1 month after treatment	1	58	Mean Difference (IV, Random, 95% CI)	-3.0 [-3.90, -2.10]
2 Pain up to 7 months after treatment	1	58	Mean Difference (IV, Random, 95% CI)	-0.5 [-1.49, 0.49]
3 Adverse events	1	58	Risk Ratio (M-H, Fixed, 95% CI)	3.57 [0.18, 71.21]
4 Tenderness - number of tender points below kg/cm^2 up to 1 month after treatment	1	58	Mean Difference (IV, Random, 95% CI)	-4.5 [-6.20, -2.80]
5 Tenderness - number of tender points below kg/cm^2 up to 7 month after treatment	1	58	Mean Difference (IV, Random, 95% CI)	-2.0 [-3.51, -0.49]

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
6 Tenderness - mean pressure threshold by pressure algometry up to 1 month after treatment	1	68	Mean Difference (IV, Fixed, 95% CI)	0.70 [0.41, 0.99]
7 Tenderness - mean pressure threshold by pressure algometry, follow up to 7 months after treatment	1	58	Mean Difference (IV, Random, 95% CI)	0.60 [0.26, 0.94]

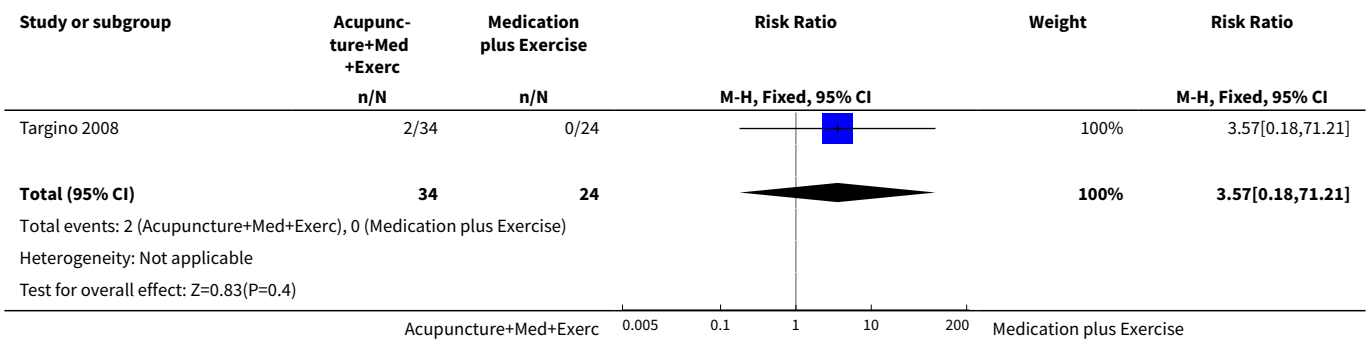
Analysis 4.1. Comparison 4 Acupuncture as an adjunct therapy, Outcome 1 Pain up to 1 month after treatment.



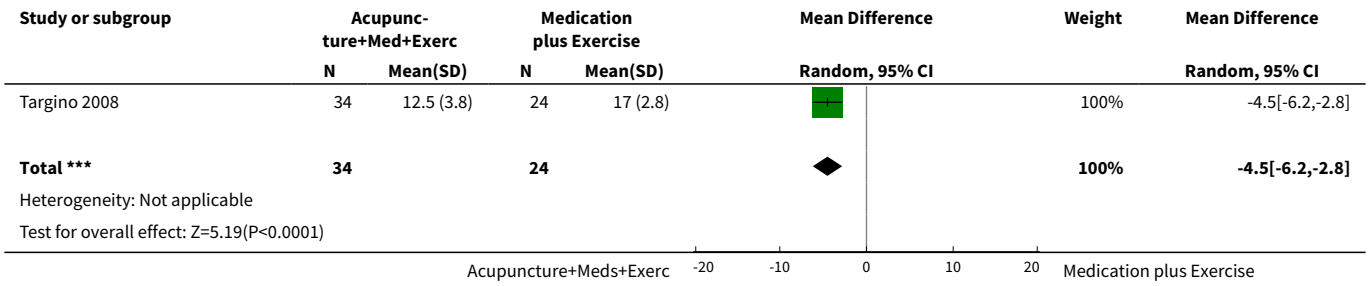
Analysis 4.2. Comparison 4 Acupuncture as an adjunct therapy, Outcome 2 Pain up to 7 months after treatment.



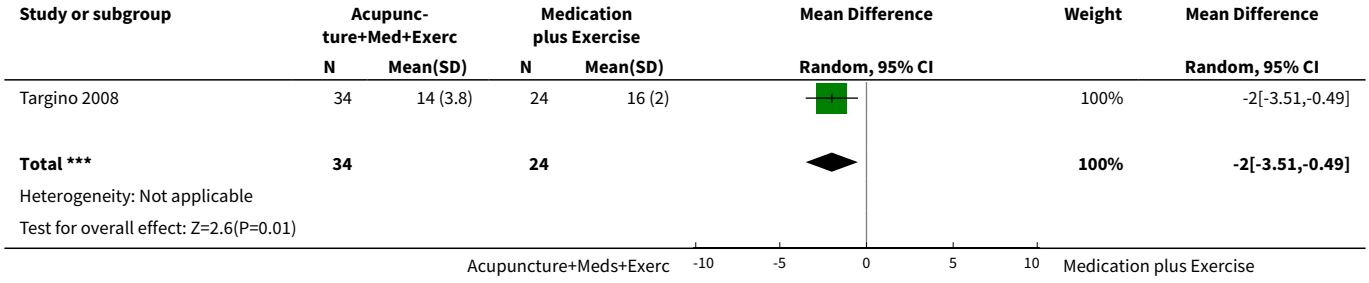
Analysis 4.3. Comparison 4 Acupuncture as an adjunct therapy, Outcome 3 Adverse events.



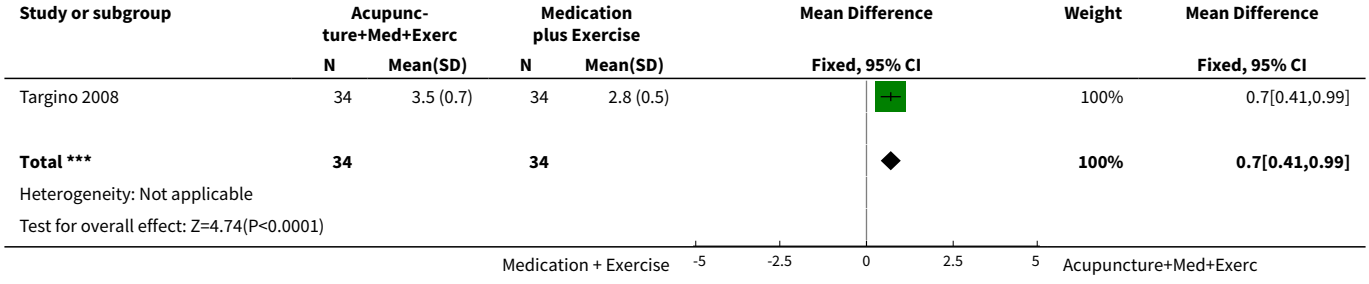
Analysis 4.4. Comparison 4 Acupuncture as an adjunct therapy, Outcome 4 Tenderness - number of tender points below kg/cm^2 up to 1 month after treatment.



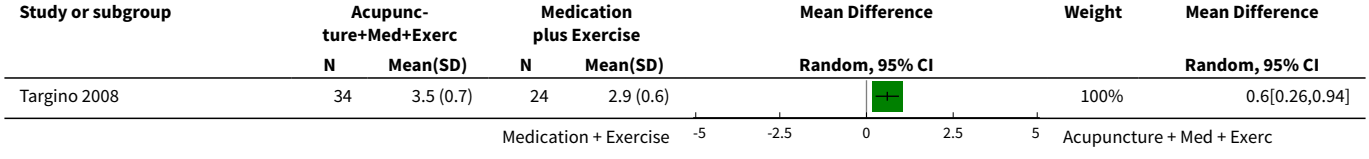
Analysis 4.5. Comparison 4 Acupuncture as an adjunct therapy, Outcome 5 Tenderness - number of tender points below kg/cm^2 up to 7 month after treatment.

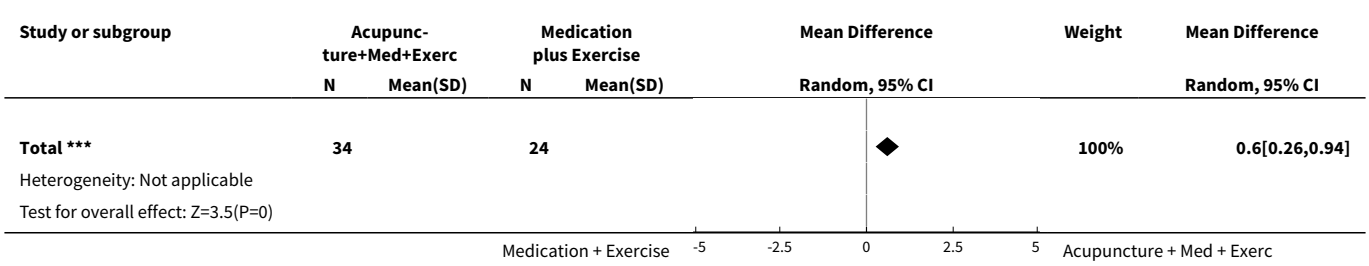


Analysis 4.6. Comparison 4 Acupuncture as an adjunct therapy, Outcome 6 Tenderness - mean pressure threshold by pressure algometry up to 1 month after treatment.



Analysis 4.7. Comparison 4 Acupuncture as an adjunct therapy, Outcome 7 Tenderness - mean pressure threshold by pressure algometry, follow up to 7 months after treatment.

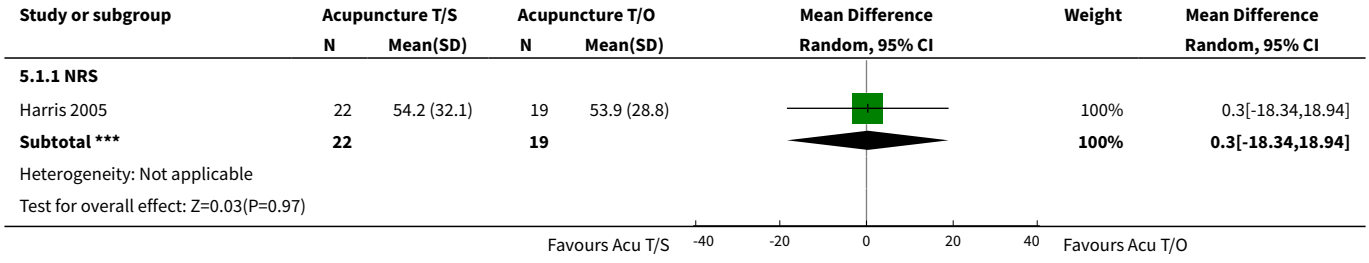




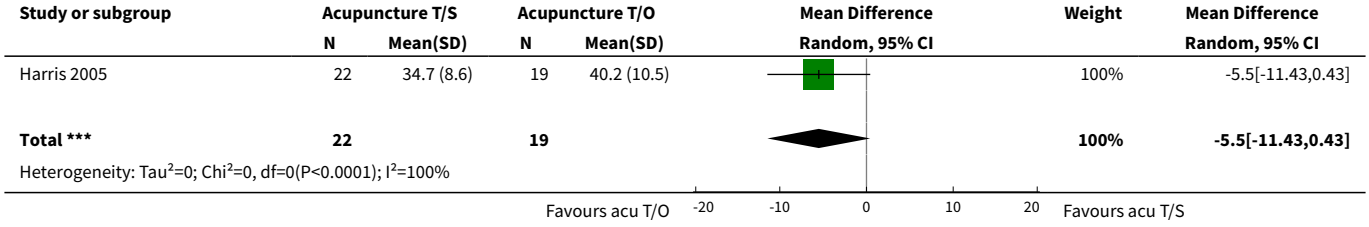
Comparison 5. Deep needling with stimulation (T/S) versus deep needling without stimulation (T/O)

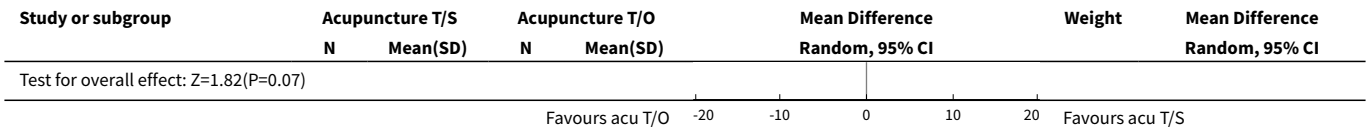
Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Pain up to 1 month after treatment	1		Mean Difference (IV, Random, 95% CI)	Subtotals only
1.1 NRS	1	41	Mean Difference (IV, Random, 95% CI)	0.30 [-18.34, 18.94]
2 Physical function (SF-36) up to 1 month after treatment	1	41	Mean Difference (IV, Random, 95% CI)	-5.50 [-11.43, 0.43]
3 Fatigue up to 1 month after treatment	1	41	Mean Difference (IV, Fixed, 95% CI)	1.10 [-1.41, 3.61]

Analysis 5.1. Comparison 5 Deep needling with stimulation (T/S) versus deep needling without stimulation (T/O), Outcome 1 Pain up to 1 month after treatment.

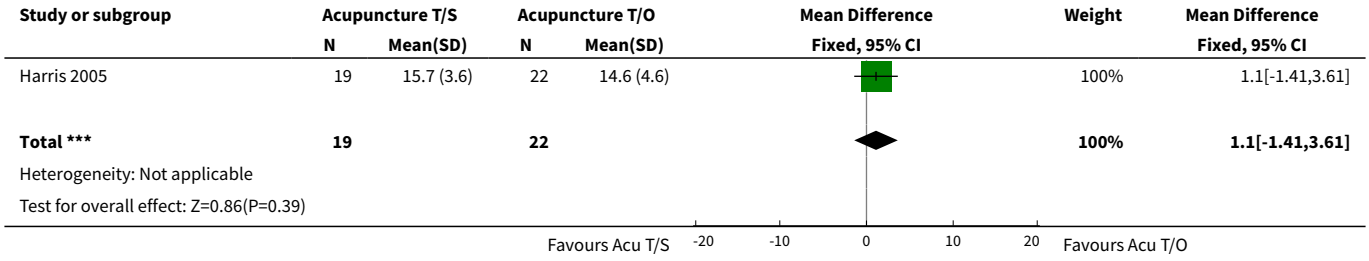


Analysis 5.2. Comparison 5 Deep needling with stimulation (T/S) versus deep needling without stimulation (T/O), Outcome 2 Physical function (SF-36) up to 1 month after treatment.





Analysis 5.3. Comparison 5 Deep needling with stimulation (T/S) versus deep needling without stimulation (T/O), Outcome 3 Fatigue up to 1 month after treatment.



APPENDICES

Appendix 1. Cochrane search strategy and results

(Updated search on 21 January 2012)

#1	MeSH descriptor Fibromyalgia explode all trees	494
#2	(fibromyal*):ti,ab,kw	790
#3	(fibromyalgia syndrome):ti,ab,kw	275
#4	(chronic widespread pain):ti,ab,kw	52
#5	(#1 OR #2 OR #3 OR #4)	817
#6	(#5 AND (randomised AND controlled AND trial))	496
#7	MeSH descriptor Acupuncture explode all trees	127
#8	MeSH descriptor Acupuncture Therapy explode all trees	2470
#9	(acupuncture point):ti,ab,kw	1628
#10	(body acupuncture):ti,ab,kw	242

(Continued)

#11	MeSH descriptor Electroacupuncture explode all trees	381
#12	(electro-acupuncture):ti,ab,kw	191
#13	MeSH descriptor Acupuncture, Ear explode all trees	91
#14	(auricular acupuncture):ti,ab,kw	166
#15	(scalp acupuncture):ti,ab,kw	160
#16	(dry needling):ti,ab,kw	71
#17	(trigger point):ti,ab,kw	360
#18	(acupoint injection):ti,ab,kw	119
#19	(#7 OR #8 OR #9 OR #10 OR #11 OR #12 OR #13 OR #14	3655
#20	(#19 AND (randomised AND controlled AND trial))	2770
#21	(#6 AND #20)	28

Appendix 2. MEDLINE search strategy and results

(Updated searched on 21 January 2012)

#22	#6 AND #21 Limits: Randomized Controlled Trial	15
#21	#7 OR #8 OR #9 OR #10 OR #11 OR #12 OR #13 OR #14 OR #15 OR #16 OR #17 OR #18 OR #19 Limits: Randomized Controlled Trial	2190
#20	#7 OR #8 OR #9 OR #10 OR #11 OR #12 OR #13 OR #14 OR #15 OR #16 OR #17 OR #18 OR #19	15315
#19	Search acupoint injection [tw]	81
#18	trigger point [tw]	520
#17	dry needling [tw]	84
#16	scalp acupuncture [tw]	110
#15	auricular acupuncture [tw]	201

(Continued)

#14	ear acupuncture [MeSH]	197
#13	electro-acupuncture [tw]	518
#12	electro-acupuncture {MeSH]	0
#11	electroacupuncture [MeSH]	2024
#10	body acupuncture [tw]	102
#9	acupuncture point [MeSH]	2962
#8	acupuncture therapy [MeSH]	14011
#7	acupuncture [MeSH]	14710
#6	#1 OR #2 OR #3 OR #4 Limits: Randomized Controlled Trial	397
#5	#1 OR #2 OR #3 OR #4	6753
#4	chronic widespread pain [tw]	305
#3	fibromyalgia syndrome [tw]	1146
#2	fibromyal* [tw]	6664
#1	fibromyalgia [MeSH]	5234
#3	fibromyalgia syndrome [tw]	1146
#2	fibromyal* [tw]	6664
#1	fibromyalgia [MeSH]	5234

Appendix 3. EMBASE search strategy and results

(Updated search on 17 January 2012)

#1 (Acupuncture and fibromyalgia).mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword]	401
#2 limit 1 to yr="2010 - 2012"	65

Appendix 4. CINAHL search strategy and results

(Via EBSCOhost updated search on 17 January 2012 then 28 March 2012)

1 TX Acupuncture AND TX Fibromyalgia	535
2 limit 1 to yr="Jan 2010 – Dec 2011"	70

Appendix 5. Chongqing Weipu (VIP) search strategy and results

Search terms	**Vip** **1989-2010** **(tw=**任意字段；**abstract=**文摘)
# 1 纤维肌痛 [tw]	273
# 2 纤维肌痛 [abstract]	212
# 3 纤维肌痛综合征 [tw]	201
# 4 纤维肌痛综合征[abstract]	158
# 5 RCT [abstract]	6443
# 6 随机对照试验[abstract]	3504
# 7临床科研[tw]	2620
# 8临床观察 [tw]	172039
# 9 随机对照 [tw]	15101
# 10 针刺[tw]	42588
# 11 针灸[tw]	67944
# 12 电针[tw]	10444
# 13 耳针 [tw]	1118
# 14 头针 [tw]	1952
# 15 水针 [tw]	2281
#1 or # 2 or #3 or #4 AND #5 or #6 or #7 or #8 or #9 AND #10 or #11 or #12 or #13 or #14 or #15	35

Appendix 6. Wanfang search strategy and results

Search terms	**Wangfang**

(Continued)

	Inception to 2010
# 1 纤维肌痛 [tw]	4109
# 2 纤维肌痛 [abstract]	3090
# 3 纤维肌痛综合征 [tw]	131
# 4 纤维肌痛综合征[abstract]	146
# 5 RCT [abstract]	4977
# 6 随机对照试验[abstract]	3686
# 7临床科研[tw]	1696
# 8临床观察 [tw]	141525
# 9 随机对照 [tw]	16801
# 10 针刺[tw]	37681
# 11 针灸[tw]	52905
# 12 电针[tw]	10225
# 13 耳针 [tw]	807
# 14 头针 [tw]	1731
# 15 水针 [tw]	1481
#1 or # 2 or #3 or #4 AND #5 or #6 or #7 or #8 or #9 AND #10 or #11 or #12 or #13 or #14 or #15	28

Appendix 7. National Research Register search strategy and results

(Updated search on 21 January 2012)

You searched for fibromyalgia AND acupuncture

"There are no results."

Appendix 8. HSRProj search strategy and results

(Updated search on 21 January 2012)

((fibromyalgia AND acupuncture) AND (randomised controlled trial))

0 result found

Appendix 9. Current Contents search strategy and results

(via Web of Science updated search on 17 January 2012 then 28 March 2012)

1 Topic=(Acupuncture) AND Topic=(fibromyalgia)	99

(Continued)

Databases=ABES, SBS, CM, LS, PCES, ECT, AH, BC, EC Timespan=All Years *Lemmatization=On*	
2 Topic=(Acupuncture) AND Topic=(fibromyalgia) Refined by: Publication Years=(2010 OR 2011) *Databases=ABES, SBS, CM, LS, PCES, ECT, AH, BC, EC Timespan=All Years* *Lemmatization=On*	22

Appendix 10. STRICTA

Detailed information of acupuncture treatment (modified STRICTA items)

Study ID	Assefi 2005	Deluze 1992	Guo 2005	Harris 2005	Harris 2008	Harris 2009	Itoh 2010	Martin 2006	Targino 2008
Acupuncture style	Manual acupuncture with formula points	Electro-acupuncture with formula points	Manual point-to-point threading acupuncture with formula points	Manual acupuncture with formula points	Manual acupuncture with formula points	Manual acupuncture with formula points	Electro-acupuncture plus trigger point acupuncture	Electro-acupuncture plus formula CM	Manual acupuncture with formula points
Rationale for treatment including 3 items: CM diagnosis/ point selection/ trial protocol	NR/NR/NR	NR/individualised with 2 main points/ points selection and EA was based on journal articles	NR/NR/NR Only mentioned "Standard treatment"	NR/points selected based on "ability to reduce symptoms of FM"/NR	NR/points selected based on Harris 2005 study/NR	NR/points selected based on Harris 2005 study/NR	NR/NR/NR	NR/points standardised formula "strong regulatory points"/NR	NR/points selected based on "Classical"/based on clinical experience
Sources to justify rationale	Clinical experience and discussion with 3 other acupuncturists	Textbook and journal articles (referenced)	Classic literature and research papers (not referenced)	Textbook (referenced) However this text does not specifically state those points are for fibromyalgia	Referenced to Harris 2005 paper	Referenced to Harris 2005 paper	NR	NR	Referenced to WHO standard nomenclature, but the reference is not related to fibromyalgia diagnosis or treatment
Points used in real acupuncture treatment	Alternating between LI11, SP9, CV12, ST25, KI7, TE5, Ex-	LI4, ST36 plus up to 6 other points which were not reported	Along GV meridian and the 2 lines of the Bladder meridian. Ex-	Unilateral Left LI11, ST36 SP6, GB34 Right LI4, LR3, plus GV20 and ear point *shenmen*	As per Harris 2005 study	As per Harris 2005 study	Points selected using trigger point therapy but does state apart from muscle groups what they were	Bilateral LI4, ST36, LR2, SP6 PC6, HT7 plus 3 cervical and 4 lumber axial on	Ex-HN-3 (Yin Tang) LR3, LI4, PC6, GB34 and SP6

(Continued)

	HN-3 (Yin Tang) and KI7, BL17, BL18, BL20, BL22, BL43, BL44		act start and finish points not reported					BL channel but did not state actual points	
Uni/bilateral	Not reported clearly	Bilateral	NR	As above	As per Harris 2005 study [MCIT1]	As per Harris 2005 study	Bilateral	As above	All bilateral except for Ex-HN-3
Number of needles inserted	7-14	10 (study used 5 pairs of electrodes)	NR	9	9	9	Real 10 for 10 wks Non-acupuncture nil for 5 wks, then 5 after wk 5	18 first 3 tx 20 final 3 tx	11
Depths of insertion	"Standard depth" (referenced to a textbook)	Real: 10 to 25 mm Control: 3 to 4 mm	Subcutaneous	All groups had the same depth, 20 to 30 mm	Real 20 mm Sham non-penetrating	Real 20 mm Sham non-penetrating	EA 5 to 20 mm Trigger point 10 to 20 mm	NR, But figure shows needling into muscles	10 to 30 mm, perpendicular insertion for all points except when needling Ex-HN-3 which was obliquely inserted
Responses elicited	"Stimulation" stated but not clear if *deqi* was elicited	Real: *deqi* elicited Control: no *deqi*	NR	*Deqi* was elicited in 2 out of the 4 arms	Real: *deqi* was elicited on all points below the neck	Real: *deqi* was elicited on all points below the neck	*Deqi* on both EA and trigger point	No *deqi* intended	*Deqi was* elicited
Type of needle stimulation	Manual	Electrical real: visible muscle twitch	Point-to-point	Lifting and thrusting with even rotation (12 rotations at 180° clock and anticlockwise	Manual	Manual	EA visible muscle twitch, 4 Hz, rectangular biphasic top	Electrical, 2 Hz, LI4 and ST36 plus 10 Hz (alternat-	Manual

(Continued)

		10 mA - continuous Control: no muscle twitch setting similar to real group but weaker	threading, even movement				Trigger point "Sparrow pecking"	ing cervical and lumber BL channel)	
Needle retention time	30 minutes	NR	30 minutes	20 minutes	25 minutes	25 minutes	EA 15 minutes Trigger point 15 minutes	20 minutes	20 minutes
Needle size/ length/ type/ manufacturer	NR/34 to 40 mm/Chinese, Japanese, Korean/NR	0.3 mm/25 mm/ Stainless steel/NR	0.35 mm/40 mm/NR/ NR	25 mm/38 mm/ Stainless steel/ HBW Supply Inc	25 mm/50 mm/ Stainless steel/ Seirin	NR/NR/ NR/NR	0.2 mm/40 mm/stainless steel/Seirin	NR/NR/NR/ NR EA unit IC-1107+, ITO, Japan	25 mm/40 mm/NR/NR
Number of treatment sessions	24 over 12 wks	6 over 3 wks	28 over 30 days with 14 for each course; a rest of 2 days in between courses	18 over 13 wks Forced-titration paradigm (1 tx wkly 3 wks), (2 tx wkly 3 wks), (3 tx wkly 3 wks) 2 wk washout between each tx group	9 over 4 wks	9 over 4 wks	10 over 10 wks (this was a cross-over study after 5 weeks. 1st 5 weeks tx was only on 1 arm with the other non-acupuncture)	6 over 3 wks	20 over 3 months
Frequency of treatments	Twice weekly	Twice weekly	Daily	As above	Twice to 3 times weekly	Twice weekly	Weekly	Every 2 to 4 days over 2 to 3 wks	Twice weekly
Practitioner background: training,	8 acupuncturists	NR	Authors from Chinese med-	Point location determined by 2 licensed acupuncturists with 12 yrs experience in fibromyalgia and 17 yrs experience in	1 acupuncturist trained at	NR	1 acupuncturist,	2 acupuncturists but no details reported	1 acupuncturist

(Continued)

clinical experience, expertise in specific condition	received standardised training in the different styles for the study. Trial acupuncturist had 15 years experience in treating fibromyalgia patients	icine university	acupuncture. 95% of tx done by 1 acupuncturist	the Maryland Institute of Traditional Chinese Medicine with 6 years clinical acupuncture experience. No expertise in a specific condition	4 yrs acupuncture training and clinical experience of 3 or 10 yrs		(physician) with 5 years clinical experience

Abbreviations used: CM: Chinese medicine; EA: electro-acupuncture; mm: millimetre; NR: not reported; tx: treatments; wk = weeks: wkly = weekly; yrs: years

WHAT'S NEW

Date	Event	Description
10 May 2008	Amended	CMSG ID A019-R
13 April 2008	Amended	Converted to new review format.

CONTRIBUTIONS OF AUTHORS

John C Deare (JD)

- Topic conception, protocol development and revision
- Systematic review study selection, methodology, adequacy of treatment, data extraction, data analysis and interpretation of findings
- Co-author of the review

Zhen Zheng (ZZ)

- Topic conception, protocol development review and revision
- Systematic review study selection, methodology, adequacy of treatment, data extraction, data analysis and interpretation of findings
- Co-author of the review

Charlie C Xue (CX)

- Topic conception and methodological aspects
- Protocol review
- Systematic review dispute resolution for study selection, adequacy of treatment, and revision and review of final interpretations of findings

Jian Ping Liu (JPL)

- Topic conception, methodological perspectives, data analysis
- Protocol revision and review
- Systematic review dispute resolution for methodological quality and final proof

Jingsheng Shang (JSS)

- Topic conception
- Protocol review proof
- Systematic review final proof

Sean W Scott (SS)

- Protocol review proof
- Systematic review data extraction
- Systematic review final proof

Geoff Littlejohn (GL)

- Protocol review proof
- Systematic review final proof

DECLARATIONS OF INTEREST

The authors plan to conduct an acupuncture clinical trial on fibromyalgia in the future. No other potential conflicts of interest have been noted.

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Internal sources

- Traditional & Complementary Medicine Program, Health Innovations Research Institute, Discipline of Chinese Medicine, School of Health Sciences, RMIT University, Australia.
- Compmed Health Institute, Southport, Australia.
- Centre for Clinical Research and Evaluation, Beijing University of Chinese Medicine, Beijing, China.

External sources

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DIFFERENCES BETWEEN PROTOCOL AND REVIEW

We updated the background and changed the order of importance of the main and minor outcomes, based on findings from reviews. In accordance with new Cochrane Collaboration guidelines, we have included in the review 'Risk of bias' and replaced the planned 'Clinical relevance tables' with the 'Summary of findings' tables. We did not conduct the searches of ACULARS, AcuBriefs, SIGLE or AMED as they could either not be accessed via RMIT University, it was a pay for service or the content of the databases was covered by our other searches.

INDEX TERMS

Medical Subject Headings (MeSH)

Acupuncture Therapy [*methods]; Fibromyalgia [*therapy]; Pain Management [methods]; Randomized Controlled Trials as Topic

MeSH check words

Humans