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Research

Massage therapy has short-term benefits for people with common musculoskeletal disorders compared to no treatment: a systematic review

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KEY WORDS

Massage therapy
Systematic review
Randomised clinical trials
Physical therapy

ABSTRACT

Question: Is massage therapy effective for people with musculoskeletal disorders compared to any other treatment or no treatment? **Design:** Systematic review of randomised clinical trials. **Participants:** People with musculoskeletal disorders. **Interventions:** Massage therapy (manual manipulation of the soft tissues) as a stand-alone intervention. **Outcome:** The primary outcomes were pain and function. **Results:** The 26 eligible randomised trials involved 2565 participants. The mean sample size was 95 participants (range 16 to 579) per study; 10 studies were considered to be at low risk of bias. Overall, low-to-moderate-level evidence indicated that massage reduces pain in the short term compared to no treatment in people with shoulder pain and osteoarthritis of the knee, but not in those with low back pain or neck pain. Furthermore, low-to-moderate-level evidence indicated that massage improves function in the short term compared to no treatment in people with low back pain, knee arthritis or shoulder pain. Low-to-very-low-level evidence from single studies indicated no clear benefits of massage over acupuncture, joint mobilisation, manipulation or relaxation therapy in people with fibromyalgia, low back pain and general musculoskeletal pain. **Conclusions:** Massage therapy, as a stand-alone treatment, reduces pain and improves function compared to no treatment in some musculoskeletal conditions. When massage is compared to another active treatment, no clear benefit was evident. **[Bervoets DC, Luijsterburg PAJ, Alessie JJN, Buijs MJ, Verhagen AP (2015) Massage therapy has short-term benefits for people with common musculoskeletal disorders compared to no treatment: a systematic review. *Journal of Physiotherapy* 61: 106–116]**

Background

A considerable proportion of the population experiences musculoskeletal disorders.[1] The Global Burden of Disease 2010 Study shows that the musculoskeletal disorders are the fourth greatest burden on health throughout the world, causing 21.3% of years lived with disability.[2] The most affected areas of the body are the low back, neck, shoulder and the knee, with a point prevalence varying between 20 and 50% of the population.[1,2]

Massage therapy is one of the earliest therapeutic tools used to relieve pain.[3,4] It has been promoted as a treatment of choice for numerous conditions such as musculoskeletal disorders, stress and pregnancy.[3] With its popularity for pain relief and recovery of function, massage therapy has become a widely accepted treatment for musculoskeletal disorders.[5] In physiotherapy practices, massage therapy plays a major role in the treatment of patients with musculoskeletal disorders. In a large cohort study, 87% of participants with complaints of the arm, neck and/or shoulder were treated with massage therapy, often in combination with exercise therapy.[6]

Massage therapy can be defined in different ways. Recently, the Ottawa panel defined massage as 'soft tissue and joint manipulation using the hands or a handheld device'.[7,8] This definition also included (spinal) manipulation and the use of mechanical devices. Another definition of massage is 'a systematic manipulation of the soft tissues of the body with rhythmical pressure and stroking to prevent, develop, maintain, rehabilitate, or augment physical function or relieve pain'.[9] Most massage styles consist of one or more of the following actions: effleurage (a gliding or sliding movement over the skin), petrissage (lifting, wringing or squeezing of soft tissues in a kneading motion, or pressing or rolling of the tissues), friction (penetrating pressure applied through the fingertips), tapotement (strike the tissues at a rapid rate) and vibration.[3,10–12]

The specific mechanisms of action of massage therapy are unknown, but various physiological responses to massage therapy have been claimed. These mechanisms include: increased lymph flow, a shift from sympathetic to parasympathetic response, prevention of fibrosis, increased clearance of blood lactate, and effects on the immune system, cognition and pain.[9,13,14] A popular claim is that massage therapy can increase blood flow to the muscles. However, this claim has been questioned, as increasing scientific evidence has shown no influence of massage therapy on blood flow.[15] Massage does seem to produce local biochemical changes, which might lead to increased neural activity at the spinal cord level and subcortical nuclei, which might affect mood and

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pain perception.[5,16] Therefore, massage therapy could potentially reduce anxiety, depression and pain through the increase of serotonin and endorphins.[13]

Previous systematic reviews of the effectiveness of massage have shown mainly short-term positive effects on low back pain, neck pain and shoulder pain.[5,7,8,17] However, these reviews have combined studies that used a variety of massage, spinal manipulation and mobilisation techniques, often as part of complementary and alternative medicine interventions.[7,8] The present review aimed to evaluate the currently available evidence of massage (ie, manual manipulation of soft tissues) as a stand-alone treatment compared to no intervention or other interventions on pain and functional status for people with musculoskeletal disorders.

Therefore, the research question for this systemic review was:

Is massage therapy effective for people with musculoskeletal disorders compared to any other treatment or no treatment?

Methods

Identification and selection of studies

PubMed, PEDro and CINAHL were searched from inception until October 2014, using medical subject headings (MeSH) and key words including anatomical terms, disorder or syndrome terms, and treatment terms. The full search strategy is presented in Appendix 1 on the eAddenda. There were no language restrictions. The references of the systematic reviews and (quasi-) randomised trials identified by the electronic searches were also scanned for potentially relevant articles.

Published, randomised controlled trials that studied the effect of massage as a stand-alone intervention (compared to no treatment or to another active intervention) in people aged over 18 years with common musculoskeletal disorders (Box 1) were included. Two review authors (DB, PL) independently performed the selection. First, titles and abstracts were screened for possible eligibility. Next, the full-text articles were independently screened for definite inclusion. The review authors resolved discrepancies through discussion or by a third author (AV).

Assessment of characteristics of studies

Quality

To assess the risk of bias, the tool from the Cochrane Back Review Group was used. This tool describes seven domains, including 12 items: sequence generation, allocation concealment, blinding of participants and personnel, blinding of outcome assessment, incomplete outcome data, selective outcome reporting and 'other issues'. Each item was rated as being at 'low', 'unclear' or 'high' risk of bias. Two review authors (DB, PL) independently assessed the risk of bias. The discrepancies were resolved through discussion and disagreements were discussed with a third review author (AV). A study was defined as being at low risk of bias when it fulfilled six or more of the criteria.

Box 1. Inclusion criteria.

Design
- Randomised trial
- Published in any language

Participants
- Adults with a common musculoskeletal disorder[a]

Intervention
- Massage, defined as systematic manual manipulation of the soft tissues of the body with rhythmical pressure and stroking

Outcome measures
- Pain
- Function

Comparisons
- Massage versus no treatment (wait list control, sham, rest or usual care)
- Massage versus other active treatments (exercise therapy, joint manipulation, relaxation therapy)

[a] Common musculoskeletal disorders were defined by the International Classification of Primary Care (ICPC) codes chapter L: locomotor system.[46]

Participants

The inclusion criteria for participants are shown in Box 1. Studies were excluded if the participants had severe pathology such as a fracture, nerve damage, psychological disorders (eg, depression) or sport injuries.

Intervention

Studies were excluded if the intervention involved joint manipulation, energy manipulation (eg, Reiki or polarity), or mechanical devices (eg, roptrotherapy). The massage therapy had to be a stand-alone treatment; trials were excluded if massage therapy was combined with another intervention (eg, massage plus joint mobilisation compared to no treatment) or additional to other active interventions (eg, massage plus exercise compared to exercise alone). The comparison therapy could not be an alternative form of massage.

Outcome measures

The outcomes of interest were pain and function. Outcome data were categorised as short term (post treatment up to 12 weeks) or long term (12 weeks or over).

Data analysis

One review author (DB) extracted data using a standardised, piloted data extraction form. A second review author (AV) checked this process by performing data extraction (independently) on a random set of studies and comparing the results. Any disagreements were resolved by discussion. In cases of more than 5% of disagreements with the random sample, two review authors performed the data extraction of all studies. Data were extracted on patient population, experimental and control interventions, and outcomes. All original data on outcomes were converted into effect estimates, which were reported as: a mean difference (MD) when a continuous outcome was measured on comparable instruments in the included studies, a standardised mean difference (SMD) when a continuous outcome was measured on different instruments in the included studies, or relative risk (RR) when the outcome was dichotomous. Each of these estimates was reported with a 95% confidence interval (CI) whenever possible. An effect of 15% or more was considered to be clinically relevant.

Statistical analyses were performed using Review Manager 5.2.[18] Statistical heterogeneity was determined using I^2 tests, which were interpreted as follows: 0 to 40% no heterogeneity; 40 to 70% moderate heterogeneity; and 70 to 100% considerable heterogeneity.[19] For statistical pooling, the random effects model was used.

The quality of the evidence was assessed using the GRADE approach.[20] The quality of the evidence starts at high when at least two trials provide results for an outcome. The quality is reduced by one level for each of the following domains not met: limitations of the study design, defined as $>25\%$ of the participants from studies with a high risk of bias; inconsistency, defined as statistical heterogeneity ($I^2 > 40\%$) or inconsistent findings among studies ($<$ 75% of the participants reported findings in the same direction); indirectness, defined as generalisability of the findings; imprecision of results, defined as total number of participants < 300 for a dichotomous outcome and < 400 for continuous outcome; and 'other', such as publication bias, flawed design or massive dropout. Single randomised trials ($n < 400$) were considered to be

inconsistent and imprecise, and provided low-quality evidence, which could be further downgraded to very-low-quality evidence.

Subgroup analyses were conducted according to the different conditions: low back pain, neck pain, shoulder pain or knee pain.

Results

Flow of studies through the review

The initial search identified 1473 records. After removing duplicates, 1313 unique hits were retained for further assessment. Of these, 1249 records were excluded on the basis of titles and abstracts, and 64 full-text studies were read to assess for eligibility. Of these, 38 studies were excluded and 26 studies were judged to be eligible for inclusion in this review (Figure 1).

Description of studies

All studies were published in English. One trial[11] had a crossover design and only the data from the first period were used in the review. The mean sample size among the studies was 95 participants (range 16 to 579). Fourteen studies recruited fewer than 25 participants per arm and the smallest study arm recruited eight participants.[21] The characteristics of the included studies are presented in Table 1.

Participants

Eight studies included participants with (chronic) low back pain (Table 1). Other studies included participants with shoulder pain (n = 4), fibromyalgia (n = 3), osteoarthritis of the knee (n = 3), chronic musculoskeletal pain (n = 2), neck pain (n = 2) or chronic patellar tendinopathy, carpal tunnel syndrome, hand pain and hand osteoarthritis (one study each).

Interventions

Despite the strict definitions in the present review, the studies used a broad variety of massage techniques, durations and frequencies. The massage therapies included: Swedish massage (n = 5), Thai massage (n = 4), self-massage (n = 1) or a combination of techniques (eg, therapeutic and structural massage) (n = 12) (Table 1). Four studies did not clearly describe the type of massage used.[22–25] Ten studies described the use of co-interventions (ie, interventions that were not a part of the planned treatment and control interventions), which were similar across groups.

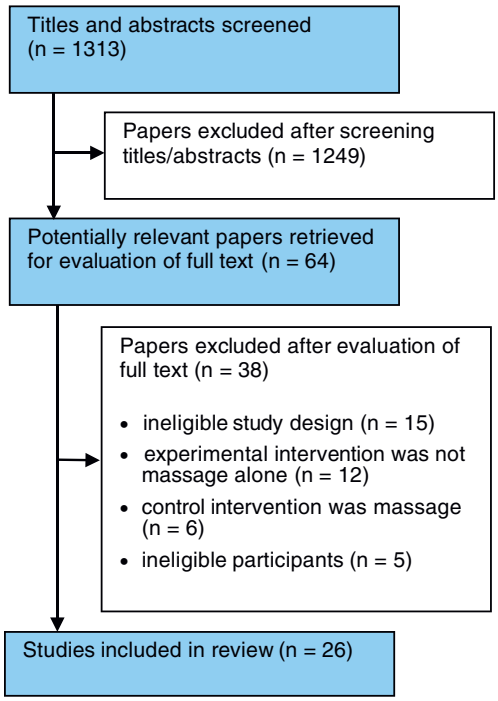

Figure 1. Flow of studies through the review.

Twenty studies allocated participants to a no-treatment, placebo or inactive-treatment control group, which included: a waiting list, no treatment, usual care, sham laser, light hand touch, medication, self-care educational materials/book, corset or passive physical treatments (eg, ultrasound therapy, hot packs or phonophoresis). Usual/standard care could include pharmacological therapy (muscle relaxants, pain medication) or advice on exercise or posture, but this was not always clearly described. Treatment periods varied from one session (n = 3) to 10 weeks (with four to ten sessions).

Eleven studies included one or more active treatment control groups: (progressive muscle) relaxation therapy (n = 5), exercises (n = 2), acupuncture (n = 2), Alexander technique lessons, joint mobilisation and manipulation.

Outcomes

Pain (intensity, threshold) was assessed in 22 studies and function in 14 studies. Although data were not extracted for this review, the other outcome measures presented were range of motion, muscle tension, stiffness and psychosocial outcomes (anxiety, depression, bothersomeness). No studies assessed recovery or sick leave. Thirteen studies did not have any follow-up measurement; in other studies, the follow-up period varied between 12 to 52 weeks.

Risk of bias in included studies

Randomisation

Of the 26 included studies, 10 were assessed as having low risk of bias (Figure 2). Fifteen studies provided detailed information on allocation sequence generation, which were regarded as adequate. In one study, the randomisation procedure was not regarded as adequate and the remaining 10 studies did not report sufficient details on the randomisation procedure (unclear risk). Ten studies reported adequate allocation concealment methods.

Blinding

When the participant was not blinded and self-assessed the primary outcomes, the outcome assessment was scored as not blinded (n = 9). Blinding of personnel was rated as high risk, as it is impossible to blind therapists. Two studies were scored as low risk in regards to participant blinding; participants were told that they might receive a sham treatment,[24] or were blinded to type of massage,[26] and 15 studies did not mention blinding (unclear risk).

Follow-up

Nine studies gave unclear information on withdrawals and loss to follow-up. An intention-to-treat analysis was presented in 11 studies.

Effects of interventions

Seventeen studies adequately reported continuous data in order to be able to calculate effect estimates. Two studies reported dichotomous data (Table 1).

Massage versus no-treatment control

Pain

All studies measured pain on a visual analogue scale (VAS); therefore, the results are presented as mean differences on a 0 to 100 mm scale. Eight studies presented short-term pain data,[11,24,27–32] of which one had high risk of bias.[11] The included disorders were: neck pain,[24] osteoarthritis of the knee,[11,30] shoulder pain[28,29,32] and low back pain.[27,31] Three studies[11,24,30] presented long-term data, which varied from 12 to 24 weeks (Table 1).

Table 1
Characteristics of the included studies.

Study	Participants	Intervention	Outcomes	Results mean (SD) or n/N (%)	Effect size SMD (95% CI) unless noted
Alnigenis (2001)[38] High risk of bias	Fibromyalgia, n = 37 Age *(yr)* range = 21 to 65 Gender = 100% F United States (rheumatology clinic) loss to follow-up = 21	Exp: Swedish massage, n = 11 Con 1: Usual care, n = 13 Con 2: Usual care and phone calls (to increase compliance), n = 13	Pain and mobility (AIMS)	4 wk (change) Pain = Exp: 0.10; Con 1: −0.02; Con 2: −0.1 Mobility = Exp: −0.6; Con 1: 2.7; Con 2: 0.9 28 wk (change) Pain = Exp: 0.9; Con 1: −1.0; Con 2: −0.3 Mobility = Exp: 0.6; Con 1: 0.0; Con 2: −1.1	
Atkins (2013)[39] High risk of bias	Knee OA, n = 40 Age *(yr)* > 50 Gender = 89% F United States (general population)	Exp: Self-massage (20 min x 2/wk x 12 wk), n = 21 Con: WLC, n = 19	Pain, stiffness, and physical functional disability (WOMAC)	No usable data	
Buttagat (2011)[27] Low risk of bias	Back pain and myofascial trigger points, n = 36 Age *(yr)* mean = 23 yr Gender = 56% F Thailand (general population)	Exp: Thai massage (30 min x 1 session), n = 18 Con: Rest on bed (30 min x 1 session), n = 18	Pain (VAS)	Post session Pain = Exp: 26 (19); Con: 48 (14)	Post session Pain = Exp minus Con: −1.3 (−2.0 to −0.6)
Buttagat (2012)[29] High risk of bias	Shoulder pain (scapulocostal syndrome), n = 20 Age *(yr)* mean, range = 25, 18 to 50 Gender = 85% F Thailand (general population)	Exp: Thai massage (30 min x 3/wk x 3 wk), n = 10 Con: Physiotherapy modalities incl. ultrasound and hot packs (3/wk x 3 wk), n = 10	Pain (VAS)	3 wk Pain = Exp: 7 (13); Con: 28 (17) 5 wk Pain = Exp: 7 (6); Con: 34 (21)	3 wk Pain = Exp minus Con: −1.3 (−2.3 to −0.3) 5 wk Pain = Exp minus Con: −1.5 (−2.5 to −0.5)
Buttagat (2012)[28] Low risk of bias	Shoulder pain (scapulocostal syndrome), n = 40 Age *(yr)* mean, range = 27, 18 to 50 Gender = 80% F Thailand (general population)	Exp: Thai massage (30 min x 1 session), n = 20 Con: Physiotherapy modalities incl. ultrasound and hot packs (30 min x 1 session), n = 20	Pain (VAS)	Post session Pain = Exp: 39 (24); Con: 47 (18)	Post session Pain = Exp minus Con: −0.4 (−1.0 to 0.3)
Cherkin (2001)[34] Low risk of bias	Low back pain, n = 262 Age *(yr)* mean, range = 45, 20 to 70 Gender = 80% F United States (primary care)	Exp 1: Therapeutic massage (10 wk), n = 78 Exp 2: Traditional Chinese medical acupuncture (10 wk), n = 94 Con: Self-care educational materials, n = 90	Function (RDQ)	10 wk Function = Exp 1: 6.3 (5.4); Exp 2: 7.9 (6.9); Con: 8.8 (6.8) 52 wk Function = Exp 1: 6.8 (5.9); Exp 2: 8.0 (6.7); Con: 6.4 (3.9)	10 wk Function = Exp 1 minus Con: −0.4 (−0.7 to −0.09); Exp 1 minus Exp 2: −0.3 (−0.6 to 0.05) 52 wk Function = Exp 1 minus Con: 0.08 (−0.2 to 0.4); Exp 1 minus Exp 2: −0.2 (−0.5 to 0.1)
Cherkin (2011)[26] Low risk of bias	Chronic low back pain, n = 402 Age *(yr)* range = 20 to 65 Gender = 63% F United States (general population)	Exp 1: Structural massage (10 wk), n = 132 Exp 2: Relaxation (10 wk), n = 136 Con: Usual care (10 wk), n = 133	Function (RDQ)	10 wk Function = Exp 1: 6.5 (4.0); Exp 2: 6 (4.4); Con: 9 (4.5) 52 wk Function = Exp 1: 7.2 (4.3); Exp 2: 6 (4.8); Con: 7.4 (4.7)	10 wk Function = Exp 1 minus Con: −0.6 (−0.8 to −0.3); Exp 1 minus Exp 2: 0.1 (−0.1 to 0.4) 52 wk Function = Exp 1 minus Con: −0.04 (−0.3 to 0.2); Exp 1 minus Exp 2: 0.3 (0.01 to 0.5)

Table 1 (*Continued*)

Study	Participants	Intervention	Outcomes	Results mean (SD) or n/N (%)	Effect size SMD (95% CI) unless noted
Field (2002)[36] High risk of bias	Fibromyalgia, n = 20 Age *(yr)* mean = 51 Gender = NS United States (general population)	Exp: Combination of massages incl. Swedish and Shiatsu (2/wk x 5 wk), n = 10 Con: Progressive muscle relaxation therapy (2/wk x 5 wk), n = 10	Pain (VAS)	5 wk Pain = Exp: 37 (29); Con: 63 (30)	5 wk Pain = Exp minus Con: −0.8 (−1.8 to 0.08)
Field (2004)[21] High risk of bias	Carpal tunnel syndrome, n = 16 Age *(yr)* mean, range = 47, 20 to 65 Gender = 93% F United States (general population)	Exp: Massage therapy incl. self-massage (4 wk), n = 8 Con: Usual care (4 wk), n = 8	Pain (VAS) Function (grip strength)	4 wk Pain = Exp: 10; Con: 53 Grip strength = Exp: 9.0; Con: 6.0	
Field (2007)[40] High risk of bias	Hand arthritis, n = 22 Age *(yr)* mean, range = 47, 20 to 65 Gender = 93% F United States (general population)	Exp: Massage therapy incl. self-massage (1/wk x 4 wk), n = 11 Con: Usual care (4 wk), n = 11	Pain (VAS) Function (grip strength)	4 wk Pain = Exp: 13; Con: 28 Grip strength = Exp: 9.4; Con: 6.1	
Field (2011)[22] High risk of bias	Hand pain, n = 46 Age *(yr)* mean = 50 Gender = NS United States (general population)	Exp: Massage therapy (4 wk), n = 23 Con: Usual care (4 wk), n = 23	Pain (VAS) Function (grip strength)	4 wk Pain = Exp: 13; Con: 28 Grip strength = Exp: 8.5; Con: 6.7	
Hasson (2004)[23] High risk of bias	Chronic musculoskeletal pain, n = 129 Age *(yr)* range = 11 to 77 Gender = 84% F Sweden (primary care) loss to follow-up = 28	Exp: Massage therapy (5 wk), n = 62 (41 completed) Con: Mental relaxation (5 wk), n = 55 (48 completed)	Pain (muscle pain scale)	5 wk Pain = Exp: 60 (25); Con: 52 (30) 12 wk Pain = Exp: 45 (27); Con: 50 (28)	5 wk Pain = Exp minus Con: 0.3 (−0.1 to 0.7) 12 wk Pain = Exp minus Con: −0.2 (−0.6 to 0.2)
Hernandez-Reif (2001)[37] High risk of bias	Chronic low back pain, n = 24 Age *(yr)* mean = 40 Gender = 52% F United States (primary care)	Exp: Massage therapy incl. Swedish and clinical techniques (2/wk x 5 wk), n = 12 Con: Progressive relaxation incl. muscle relaxation exercises (2/wk x 5 wk), n = 12	Pain (VAS)	5 wk Pain = Exp: 17 (23); Con: 29 (28)	5 wk Pain = Exp minus Con: −0.5 (−1.3 to 0.4)
Irnich (2001)[24] Low risk of bias	Chronic neck pain, n = 177 Age *(yr)* mean, range = 52, 18 to 85 Gender = 62% F Germany loss to follow-up = 14	Exp1: Massage (3 wk), n = 60 (57 completed) Exp2: Acupuncture (3 wk), n = 56 (49 completed) Con: Sham laser (3 wk), n = 61 (57 completed)	Pain (VAS)	4 wk (change) Pain = Exp 1: −8 (28); Exp 2: −24 (28); Con: −17 (28) 12 wk (change) Pain = Exp 1: −14 (32); Exp 2: −17 (30); Con: −17 (26)	4 wk Pain = Exp1 minus Con: 0.3 (−0.04 to 0.7); Exp 1 minus Exp 2: 0.6 (0.2 to 1. 0) 12 wk Pain = Exp 1 minus Con: 0.1 (−0.3 to 0.5); Exp 1 minus Exp 2: 0.1 (−0.3 to 0.5)
Little (2008)[41] Low risk of bias	Low back pain, n = 579 Age *(yr)* mean = 46 Gender = NS England (primary care)	Exp 1: Massage (1/wk x 6 wk), n = 75 Exp 2: Massage (1/wk x 6 wk) + exercises, n = 72 Exp 3: Alexander technique (6 lessons in 4 wk), n = 144 Exp 4: Alexander technique (24 lessons in 9 mth), n = 144 Exp 5: Exercise prescription and behavioural counselling, n = 72 Con: Control (normal care), n = 72	Pain (days with pain during the past 4 wk) Function (RDQ)	No usable data	
Lund (2006)[42] High risk of bias	Fibromyalgia, n = 19 Age *(yr)* mean = 51 Gender = 100% F Sweden (secondary care)	Exp: Massage, incl. effleurage, petrissage, friction and shaking (30 min x 2/wk x 6 wk), n = 10 Con: Guided relaxation (30 min x 2/wk x 6 wk), n = 9	Pain	No usable data	

Mackawan (2007)[35] High risk of bias	Chronic low back pain, n = 67 Age *(yr)* range = 20 to 60 Gender = 61% F Thailand (general population)	Exp: Thai massage (1 session), n = 35 Con: Joint mobilisation (1 session), n = 32	Pain (VAS)	Post session Pain = Exp: 25 (18); Con: 34 (17)	Post session Pain = Exp minus Con: −0.55 (−1.03 to −0.06)
Melancon (2005)[25] High risk of bias	Low back pain, n = 60 Age *(yr)* mean = 38 Gender = 45% F United States (primary care)	Exp: Massage therapy, n = 30 Con: Usual care, eg, muscle relaxants, NSAIDS, n = 30	Pain (VAS) Disability (ODI)	No usable data	
Perlman (2006)[11] Cross-over trial High risk of bias	Knee OA, n = 68 Age *(yr)* mean = 68 Gender = 78% F United States (primary care, specialised care)	Exp: Swedish massage therapy (8 wk), n = 34 Con: WLC (8 wk), n = 34	Pain (VAS) Pain, stiffness, and physical functional disability (WOMAC)	8 wk (change) Pain = Exp: −23 (26); Con: −2 (21) WOMAC-function = Exp: −20 (22.5); Con: −5.2 (16.4) WOMAC-global = Exp: −21.2 (22.5); Con: −4.6 (15.9)	8 wk Pain = Exp minus Con: −0.9 (−1.4 to −0.4) WOMAC-function = Exp minus Con: −0.7 (−1.2 to −0.3) WOMAC-global = Exp minus Con: −0.9 (−1.4 to −0.3)
Perlman (2012)[30] Low risk of bias	Knee OA, n = 125 Age *(yr)* mean = 64 Gender = 70% F United States (mixed population) loss to follow-up = 6	Exp 1: Swedish massage (30 min x 1/wk x 8 wk), n = 25 Exp 2: Swedish massage (30 min x 2/wk x 8 wk), n = 25 Exp 3: Swedish massage (60 min x 1/wk x 8 wk), n = 25 Exp 4: Swedish massage (60 min x 2/wk x 8 wk), n = 25 Con: Usual care (current treatment), n = 25	Pain (VAS) Pain, stiffness, and physical functional disability: (WOMAC)	8 wk (change) Pain = Exp 1: −14 (26); Exp 2: −26 (27); Exp 3: −40 (21); Exp 4: −31 (21); Con: −10 (22) WOMAC = Exp 1: −17.4 (19.0); Exp 2: −18.4 (22.9); Exp 3: −24.0 (20.2); Exp 4: −24.0 (22.2); Con: −6.3 (16.1) 24 wk (change) Pain = Exp 1: −14 (28); Exp 2: −14 (27); Exp 3: −19 (26); Exp 4: −23 (32); Con: −12 (24) WOMAC = Exp 1: −14.3 (20.6); Exp 2: −7.0 (21.5); Exp 3: −14.2 (23); Exp 4: −15.1 (25.5); Con: −6.0 (16.4)	8 wk Pain = Exp 2 minus Con: −0.7 (−1.2 to −0.08) WOMAC-function = Exp 2 minus Con: −0.5 (−1.1 to 0.04) WOMAC-global = Exp 2 minus Con: −0.6 (−1.2 to −0.04) 24 wk Pain = Exp 2 minus Con: −0.1 (−0.5 to 0.7) WOMAC-function = Exp 2 minus Con: −0.1 (−0.9 to 0.7) WOMAC-global = Exp 2 minus Con: −0.05 (−0.6 to 0.5)
Pope (1994)[31] High risk of bias	Subacute low back pain, n = 164 Age *(yr)* mean = 32 Gender = 62% F United States (secondary care) loss to follow-up = 20	Exp 1: Swedish massage (3 wk), n = 37 Exp 2: Manipulation (3 wk), n = 70 Con 1: Transcutaneous muscle stimulation (3 wk), n = 28 Con 2: Corset (3 wk), n = 29	Pain (VAS)	3 wk (change score) Pain = Exp 1: −17 (25); Exp 2: −24 (27); Con 1: −10 (30); Con 2: −16 (27)	3 wk Pain = Exp 1 minus Con 2: −0.05 (−0.6 to 0.5); Exp1 minus Exp 2: 0.3 (−0.2 to 0.7)
Sherman (2009)[43] Low risk of bias	Chronic neck pain, n = 64 Age *(yr)* mean, range = 69, 20 to 64 Gender = 69% F United States (primary care) loss to follow-up = 6	Exp: Massage incl. Swedish and clinical techniques (10 wk), n = 32 Con: Self-care book, n = 32	Function (improvement of $\geq$ 10% on NDI)	10 wk NDI = Exp: 12/31 (39%); Con: 4/28 (14%) 26 wk NDI = Exp: 17/30 (57%); Con: 9/28 (31%)	10 wk NDI = Exp versus Con: RR 2.6 (0.95 to 7.2) 26 wk NDI = Exp versus Con: RR 1.7 (0.9 to 3.1)
Stasinopoulos (2004)[44] High risk of bias	Chronic patellar tendinopathy, n = 30 Age *(yr)* range = 21 to 33 Gender = 40% F Greece (secondary care)	Exp 1: Transverse friction (4 wk), n = 10 Exp 2: Exercise programme (4 wk), n = 10 Con: Pulsed ultrasound (4 wk), n = 10	Pain ('no pain or much better' versus 'slightly better, same or worse')	4 wk Pain = Exp 1: 2/10 (20%); Exp 2: 8/10 (80%); Con: 1/10 (10%) 16 wk Pain = Exp: 2/10 (20%); Exp 2: 10/10 (100%); Con: 0/10 (0%)	4 wk Pain = Exp 1 versus Con: RR 2.0 (0.21 to 18.69); Exp 1 versus Exp 2: RR 0.25 (0.07 to 0.90) 16 wk Pain = Exp 1 versus Con: ARR 0.80 (0.38 to 0.94); Exp 1 versus Exp 2: RR 0.20 (0.06 to 0.69)

Table 1 (*Continued*)

Study	Participants	Intervention	Outcomes	Results mean (SD) or n/N (%)	Effect size SMD (95% CI) unless noted
Van den Dolder (2003)[32] Low risk of bias	Shoulder pain, n = 29 Age (*yr*) mean, range = 68, 18 to 80 Gender = 69% F Australia (secondary care)	Exp: Soft tissue massage (2 wk), n = 15 Con: WLC (2 wk), n = 14	Pain (VAS) Disability (PSFDM)	2 wk Pain (VAS) = Exp: 32 (26); Con: 54 (26) Disability = Exp: 17.6 (8.0); Con: 10.4 (5.6)	2 wk Pain VAS = Exp minus Con: –0.8 (–1.6 to –0.05) Disability = Exp minus Con: –1.0 (–1.8 to –0.2)
Walach (2003)[45] High risk of bias	Chronic musculoskeletal pain, n = 29 Age (*yr*) range = 16 to 65 Gender = 90% F Germany (primary care)	Exp: Swedish massage (5 wk), n = 19 Con: Usual care incl. pharmacological therapy, advice on exercise and posture (5 wk), n = 10	Pain (VAS)	No data	
Yang JL (2012)[33] Low risk of bias	Posterior shoulder tightness, n = 60 Age (*yr*) mean = 54 Gender = 72% F Taiwan (secondary care) Loss to follow-up = 8	Exp: Soft tissue massage (4 wk), n = 30 Con: Light hand touch (4 wk), n = 30	Function (FLEX-SF)	4 wk Function = Exp: 40.5 (5.2); Con: 31.7 (3.8)	4 wk Function = Exp minus Con: –1.9 (–2.5 to –1.2)

A negative effect estimate means the effect is in favour of massage.
AIMS = Arthritis Impact Measurement Scales (0 to 10), ARR = absolute risk reduction, CI = confidence interval, Con = control group, Exp = experimental group, F = female, FLEX-SF = self-reported Flexilevel, NDI = Neck Disability Index (0 to 100), NMQ = Nordic Musculoskeletal Questionnaire, NS = not specified, OA = osteoarthritis, ODI = Oswestry Disability Index (0 to 50), PSFDM = Patient Specific Functional Disability Measure (0 to 10), RDQ = Roland Disability Questionnaire (0 to 23), RR = relative risk, SFMPQ = Short Form McGill Pain Questionnaire (0 to 15), SMD = standardised mean difference, VAS = visual analogue scale (0 to 100), WLC = waiting-list control, WOMAC = Western Ontario and McMaster Universities Osteoarthritis Index.

In the short term, the pooled estimate from the three studies involving participants with shoulder pain and with a low risk of bias was a mean difference of –16 mm (95% CI –25 to –7, I^2 = 15%).[28,29,32] Both studies involving participants with low back pain and with a low risk of bias[27,31] showed no benefit of massage over no treatment, but heterogeneity was considerable (MD = –12, 95% CI –32 to 8, I^2 = 81%). Two studies included participants with osteoarthritis of the knee,[11,30] of which one had low risk of bias, with a pooled estimate of MD –19 (95% CI –28 to –10, I^2 = 0%). One study involving participants with neck pain and with a low risk of bias[24] showed no statistically significant benefits (Figure 3). For a detailed forest plot, see Figure 4 on the eAddenda. The effect estimates of 16 to 19 mm on the VAS were considered to be clinically relevant.

It was concluded that, in the short term, there is moderate-level evidence that massage reduces pain compared to no treatment in people with shoulder pain but not in those with low back pain (both downgraded by imprecision). Furthermore, there is low-level evidence that massage reduces pain compared to no treatment in people with osteoarthritis of the knee (downgraded by imprecision and design) but is ineffective compared to no treatment in those with neck pain (single study).

Function

In the studies on shoulder pain,[32,33] function was measured with different instruments; therefore, pooled results are presented as standardised mean differences. In the studies on low back pain,[26,34] function was measured using the Roland Disability Questionnaire (RDQ), which ranges from 0 to 24. In the studies on osteoarthritis of the knee,[11,30] function was measured with the Western Ontario and McMaster Universities Arthritis Index (WOMAC), which also ranges from 0 to 24.

Six studies provided data on short-term function,[11,26,30,32–34] of which, one had high risk of bias.[11] Three studies[11,26,34] presented long-term data varying from 12 to 52 weeks (Table 1).

In the short term, the pooled estimate of the two studies with low risk of bias involving participants with shoulder pain was a standardised mean difference of –1.5 (95% CI –2.3 to –0.6, I^2 = 63%), with substantial heterogeneity (Figure 5).[32,33] For a detailed forest plot, see Figure 6 on the eAddenda. An effect estimate of 1.5 is regarded as a large effect size. The pooled estimate of the two studies with low risk of bias involving participants with low back pain was a mean difference of –2.5 (95% CI –3.4 to –1.6, I^2 = 0%), which is not considered to be a clinically relevant difference.[26,34] The pooled estimate of the two studies on osteoarthritis of the knee[11,30] was a mean difference of –13.0 (95% CI –20.1 to –5.9, I^2 = 0%), which is considered to be clinically relevant (Figure 7). For a detailed forest plot, see Figure 8 on the eAddenda.

It was concluded that, in the short term, there is moderate-level evidence that massage improves function compared to no treatment in people with low back pain (downgraded by imprecision). Furthermore, there is low-level evidence that massage improves function compared to no treatment in people with shoulder pain (downgraded by inconsistency and imprecision) and those with osteoarthritis of the knee (downgraded by design and imprecision).

Massage versus active treatments

Pain

All studies except one[23] measured pain using a VAS; therefore, data are presented as mean differences on a 0 to 100 mm scale. Six studies provided data on short-term pain,[23,24,31,35–37] of which one had low risk of bias.[24] The disorders examined in the included studies were fibromyalgia,[36] general pain[23] and low back pain,[37] which were all compared to relaxation treatment; low back pain[31,35] was compared to mobilisation/manipulation and neck pain[24] was compared to acupuncture. Because the studies differed in the musculoskeletal disorder, the comparative treatment, or both, studies were not pooled (Figure 9). For a detailed forest plot,

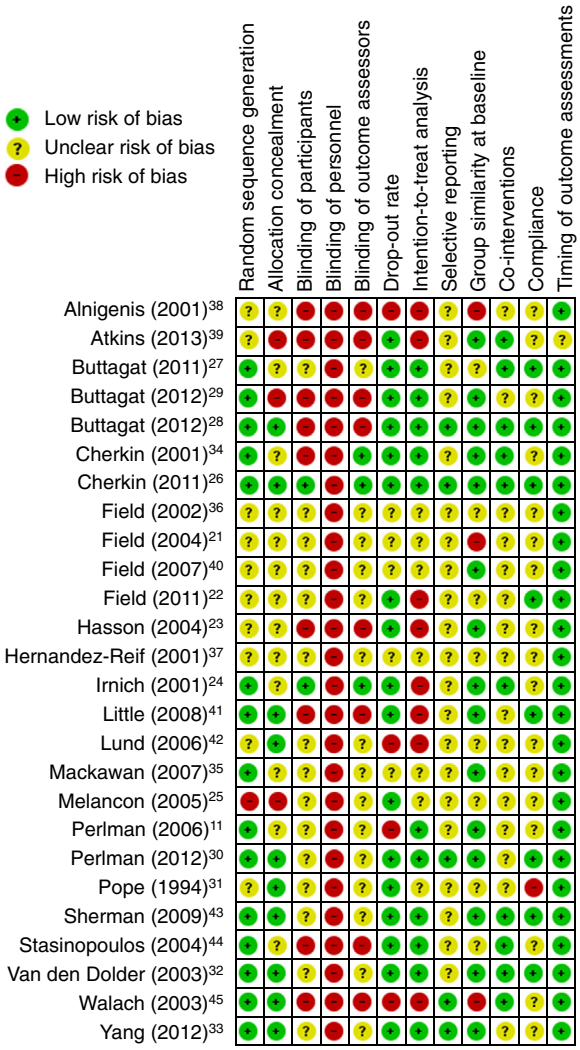

Figure 2. Risk of bias of the included studies assessed using the Cochrane Back Review Group tool.

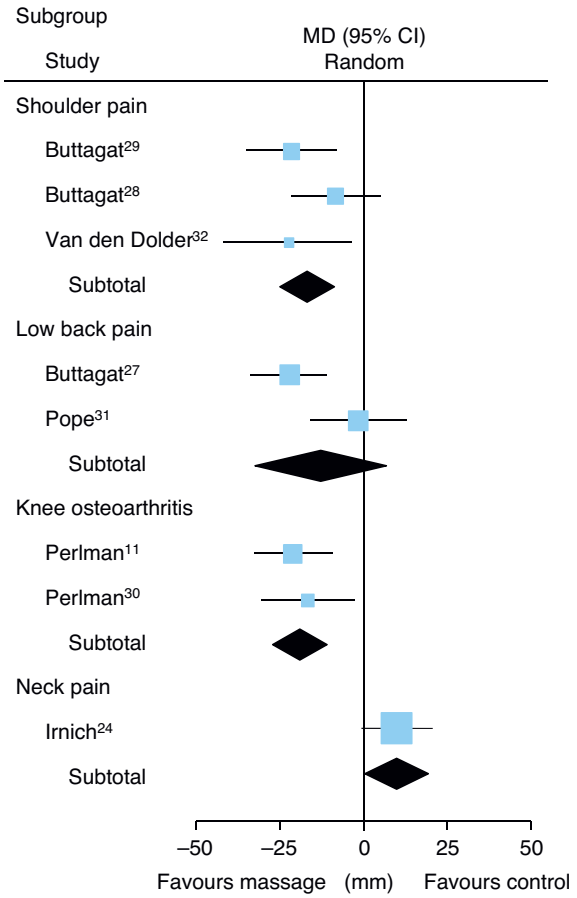

Figure 3. Weighted mean differences (95% CI) in the effect of massage versus control on pain measured on a visual analogue scale (0 to 100 mm), pooling data from three trials on shoulder pain (n = 89), two trials on low back pain (n = 93), two trials on osteoarthritis of the knee (n = 118), and one trial on neck pain (n = 114).

see Figure 10 on the eAddenda. Two studies[23,24] provided long-term data (12 weeks), as shown in Table 1.

It was concluded that there is low-level evidence (single study) that acupuncture reduces pain more than massage in people with neck pain. Furthermore, there is very-low-level evidence (single study, downgraded by design) that massage reduces pain more than joint mobilisation in people with low back pain, but that there is no benefit of massage over manipulation or relaxation therapy in those with fibromyalgia, low back pain and musculoskeletal pain.

Function

Two studies with low risk of bias presented data on function, which was measured with the RDQ in the short and long term (52 weeks) for people with low back pain, where massage was compared to relaxation treatment[26] or acupuncture (Figure 11).[34] For a detailed forest plot, see Figure 12 on the eAddenda.

There is low-level evidence (two single studies) that massage does not improve function more than acupuncture or relaxation in people with low back in the short term; in the long term, relaxation seems superior to massage.

Discussion

Overall, low to moderate levels of evidence were found for the benefits of massage over no treatment. Furthermore, low to very low levels of evidence were found for the lack of benefit of massage over other active treatments. The participants in the included studies had low back pain, shoulder pain, osteoarthritis of the knee, neck pain or fibromyalgia. Only the short-term data (ie, post treatment up to 12 weeks) could be pooled. Control interventions were conservative treatments such as relaxation, manipulation, joint mobilisation and acupuncture. These findings suggest that massage might be a viable treatment option for several musculoskeletal disorders.

This systematic review was limited to clearly defined massage techniques as stand-alone treatments without joint manipulation or mobilisation techniques, as defined by others.[7,8] This definition of massage most closely mirrors the massage treatment that is provided by physiotherapists. The Swedish technique predominates in clinical settings and is comparable with the frequently used technique in physiotherapy practice. One of the challenges in conducting a systematic review in the field of massage therapy is the lack of consistent terminology. Therefore, a standardised

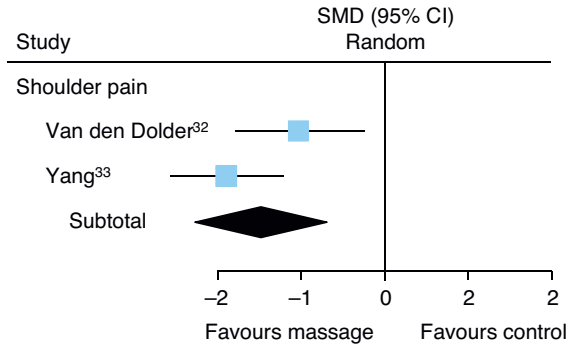

Figure 5. Standardised mean differences (SMD) (95% CI) in the effect of massage versus control on shoulder function, pooling data from two trials on shoulder pain (n = 81).

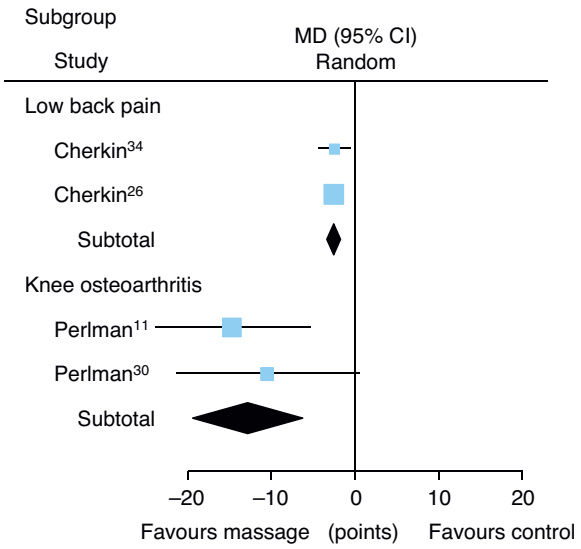

Figure 7. Weighted mean differences (MD) (95% CI) in the effect of massage versus control on function measured on 0-to-24 point scales, pooling data from two trials on low back pain (n = 410) using the Roland Disability Questionnaire (RDQ) and two trials on osteoarthritis of the knee (n = 118) using the Western Ontario and McMaster Universities Arthritis Index (WOMAC).

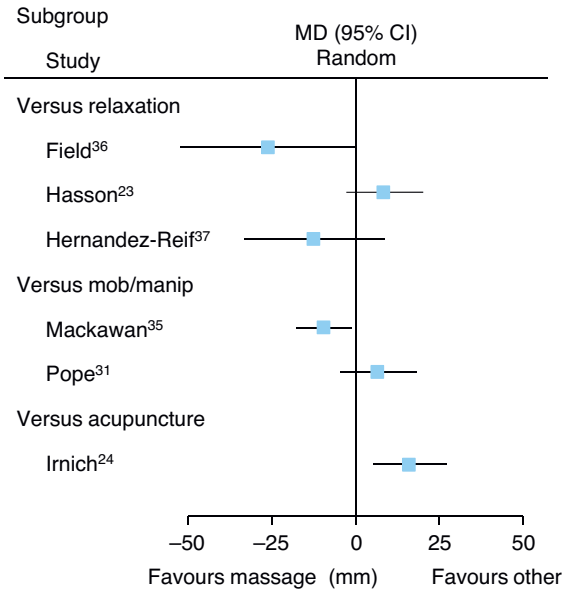

Figure 9. Weighted mean differences (MD) (95% CI) in the effect of massage versus other active treatments on pain measured on a visual analogue scale (0 to 100 mm), presenting data from three trials on massage versus relaxation, two trials on massage versus mobilisation and/or manipulation (mob/manip), and one trial on massage versus acupuncture.

taxonomy for massage is warranted. This will enable researchers and massage therapists to more clearly communicate about the nature of massage treatment and its effectiveness. Furthermore, it was found that studies only reported the frequency of the intervention; treatment parameters should also include the type of massage, the duration of a massage session, and the intensity or grade/depth of pressure. One study did indicate that there might be a dose-response relationship.[30]

The evidence identified by this review indicates that the effect of massage can best be found immediately after treatment and when compared to no treatment. Few studies included a follow-up measurement. Three studies even assessed the outcomes immediately after a single massage session. In a meta-analysis, the authors challenged the assumption that biological effects of massage only occur immediately.[13] The present review found statistically significant pain reduction immediately after a single massage session in two of these studies. This biological paradigm needs to be further evaluated. In addition, this review found no significant trend based on the duration of a massage session.[13] Neither the optimal frequency nor duration of massage treatments for pain reduction and the 'decay' in analgesic effect on pain is known. Future massage trials will benefit when these parameters are established.

The differences between these results and those of other reviews can be attributed to the different definitions of massage techniques and the fact that studies were only included in this review if they evaluated massage as a stand-alone treatment instead of a combined intervention.[5,7,8,10] This review found clearer benefit of massage versus no treatment compared to the previous reviews.

The most recent Cochrane review on massage for people with neck pain found that the effect of massage remains uncertain.[5] This is in accordance with the present results on people with neck pain. The Cochrane review included a wide spectrum of massage-therapy studies, including muscle stretching techniques and joint mobilisation. Just two of their studies were included in this review.

A weakness of this review is that the primary studies had some limitations. The majority of studies (16 out of 26) had high risk of bias. Because massage often precluded blinding of participants or care providers, the majority of the studies were rated 'unclear' or 'high risk of bias' in relation to blinding. Blinding of participants, care providers and outcome assessors was often not achieved. Consequently, not being able to blind trial participants may lead to exaggerated treatment-effect estimates. Another limitation was the sample size. Fifteen studies recruited fewer than 25 participants per arm and the smallest study arm included eight

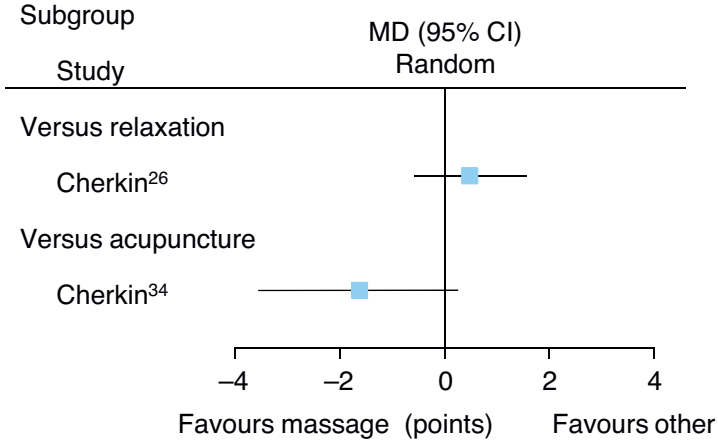

Figure 11. Weighted mean differences (MD) (95% CI) in the effect of massage versus other active treatments on function of low back pain measured on the 0-to-24 point Roland Disability Questionnaire (RDQ), presenting data from two trials.

participants. This means that any clinically relevant effects may not be detected as statistically significant effects.

A strength of the review is that it evaluated massage techniques using a strict definition. The definition allowed selection of those studies relevant to physiotherapists. Furthermore, a comprehensive search of multiple databases was conducted, and bias was minimised and internal validity was improved by the rigorous methodology. The external validity depends on the broad variation of participant populations and massage techniques included.

With regard to implications for clinicians arising from this review, the results show that massage as a stand-alone treatment reduces pain and improves function. The results – especially the ones where massage is compared to no treatment – are clinically relevant, mainly in people with low back pain, shoulder pain or osteoarthritis of the knee. In other patient populations, the effectiveness of massage is hardly evaluated.

With regard to implications for further research, this review highlights the need for better and larger studies of the efficacy and acceptability of massage therapies in other patient populations. The promising findings need further confirmation. Future studies of massage therapy need to report greater detail about the intervention beyond its frequency (sessions per week), and should include the type of massage, the duration of a massage session, and the intensity or grade/depth of pressure. Furthermore, a standardised taxonomy for massage is warranted. This would significantly assist researchers in selecting appropriate techniques and interpreting the results of massage studies.

What is already known on this topic: Musculoskeletal disorders cause pain and disability in a substantial proportion of the population. Existing systematic reviews of massage for these disorders do not include several relevant trials and some do not distinguish the effect of massage from other manual therapies.

What this study adds: Massage reduces pain, in the short term, in shoulder pain and osteoarthritis of the knee. Massage improves function, in the short term, in shoulder pain, low back pain and osteoarthritis of the knee. Massage is not clearly more or less beneficial that other commonly used treatments for musculoskeletal disorders.

eAddenda: Figures 4, 6, 8, 10 and 12 and Appendix 1 can be found online at doi:10.1016/j.jphys.2015.05.018.

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Further reading

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