# Specific stabilisation exercise for spinal and pelvic pain: A systematic review

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The aim of this study was to conduct a systematic review of the efficacy of specific stabilisation exercise for spinal and pelvic pain. Randomised clinical trials evaluating specific stabilisation exercise were identified and retrieved. Outcomes were disability, pain, return to work, number of episodes, global perceived effect, or health-related quality of life. A single trial reported that specific stabilisation exercise was more effective than no treatment but not more effective than spinal manipulative therapy for the management of cervicogenic headache and associated neck pain. Single trials reported that specific stabilisation exercise was effective for pelvic pain and for prevention of recurrence after an acute episode of low back pain but not to reduce pain or disability associated with acute low back pain. Pooled analyses revealed that, for chronic low back pain, specific stabilisation exercise was superior to usual medical care and education but not to manipulative therapy, and no additional effect was found when specific stabilisation exercise was added to a conventional physiotherapy program. A single trial reported that specific stabilisation exercise and a surgical procedure to reduce pain and disability in chronic low back pain were equally effective. The available evidence suggests that specific stabilisation exercise is effective in reducing pain and disability in chronic but not acute low back pain. Single trials indicate that specific stabilisation exercise can be helpful in the treatment of cervicogenic headache and associated neck pain, pelvic pain, and in reducing recurrence after acute low back pain. **[Ferreira PH, Ferreira ML, Maher CG, Herbert RD and Refshauge K (2006): Specific stabilisation exercise for spinal and pelvic pain: A systematic review. *Australian Journal of Physiotherapy* 52: 79–88]**

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## Introduction

Spinal pain is common. There is a lifetime prevalence of 35–40% for cervical pain (Bovim et al 1994), 11–15% for thoracic pain (Awwad et al 1991, Williams et al 1989), 60–70% for lumbar pain (Waddell 1998), and 15% for pelvic pain (Maigne et al 1996). Despite attempts to find common factors that link pain of spinal and pelvic origin to precise aetiology, the cause of the majority of spinal pain remains unknown. The lack of diagnostic data has led to many theories proposing causation of spinal pain.

Panjabi (1992a) proposed a mechanism for the development and recurrence of spinal pain. His *spinal stability* model assumes that three systems—the articular, muscular, and neural systems—work together to provide stabilisation by controlling intervertebral movement. This theory has also been expanded to the control of pelvic joints (Vleeming et al 1997).

In keeping with Panjabi's theory, changes in recruitment of specific deep spinal muscles thought to be responsible for the control of spinal stability have been reported in people with spinal pain. The onset of activity of the deep abdominal muscle, transversus abdominis, is delayed in people with recurrent episodes of low back pain (Hodges and Richardson 1996, 1998). Atrophic changes have been identified in multifidus, a deep paraspinal muscle, after episodes of low back pain (Rantanen et al 1993, Hides et al 1996). Other theorists have argued the importance of specific stabilising muscles in the aetiology of pelvic (Vleeming et al 1997, Richardson et al 1999) and cervical pain (Watson and Trott 1993). From this literature, a protocol has been developed for retraining control of the stabilising muscles around the spine and pelvis (Richardson et al 1999). Typically, during the implementation of the specific stabilisation exercise protocol, the patient is taught to recruit the deep muscles of the spine and gradually reduce unwanted overactivity of other muscles. Progression is achieved by incorporating co-contraction of the stabilising muscles into functional tasks (Richardson et al 1999).

Despite the popularity of the specific stabilisation exercise protocol in the treatment of spinal and pelvic pain (Stuge et al 2004) there is no systematic review of the efficacy of this intervention. The aim of this study was to conduct a systematic review of the effects of specific stabilisation exercise for spinal or pelvic pain when this intervention was compared with placebo, no treatment, another active treatment, or when specific stabilisation exercise was added as a supplement to other interventions.

## Method

*Criteria for inclusion of trials*  To be included in the review, studies had to be randomised clinical trials reported in any language. Participants had to be adults with symptoms in the cervical, thoracic, low back, or pelvic area. Symptoms could be referred to the arms (from cervical and thoracic spine) or to the legs (from lumbar spine or pelvis). Studies had either to mention explicitly that at least one treatment group received 'specific stabilisation exercise' or to describe exercise as aimed at activating, training, or restoring the stabilisation function of specific muscles of the spine and pelvis such as deep neck flexors, multifidus, transversus abdominis, diaphragm, or pelvic floor muscles. Specific stabilisation exercise could be administered in isolation or in conjunction with other therapies. Measures of at least one

Table 1. Details of all included randomised controlled trials.

| Study | Symptoms (site and duration) | Comparison | Description of SSE (individual vs group / frequency and duration / method of feedback for training) |
|---|---|---|---|
| Brox et al 2003 | low back > 12 month | surgery (lumbar fusion) + physiotherapy vs SSE + education | individual 1/week × 3 weeks not mentioned |
| Cairns et al 2000 | low back recurrent | SSE + conventional physiotherapy vs conventional physiotherapy alone | individual 1/week × 12 weeks ultrasonography |
| Goldby et al 2000 | low back > 3 months | SSE vs SMT vs education | individual initially, group later 1/week × 10 weeks video |
| Hides et al 1996 | 1st episode of low back < 3 weeks | SSE + medical management vs medical management | individual 2/week × 4 weeks ultrasonography |
| Hides et al 2001 | 1st episode of low back < 3 weeks | SSE + medical management vs medical management | individual 2/week × 4 weeks ultrasonography |
| Jull et al 2002 | cervical/headache > 2 months | SSE vs control (no PT intervention) SMT vs control (no PT intervention) + interaction between SSE and SMT | individual minimum of 8 and maximum of 12 sessions over 6 weeks pressure biofeedback |
| Kladny et al 2003 | low back recurrent | SSE + conventional physiotherapy vs conventional physiotherapy (SMT/ stretching) | individual not mentioned not mentioned |
| Koumantakis et al 2003 | low back recurrent | SSE + general exercise + education vs general exercise + education | individual 2/week × 8 weeks not mentioned |
| Moseley 2002 | low back > 2 months | SSE + SMT + education vs medical practitioner | individual 2/week × 4 weeks not mentioned |
| Niemisto et al 2003 | low back > 3 months | SSE + SMT + education vs education | individual 1/week × 4 weeks not mentioned |
| O' Sullivan et al 1997 | low back > 3 months | SSE vs heat + massage + swimming + walking | individual 1/week × 10 weeks pressure biofeedback |
| Rasmussen-Barr et al 2003 | low back > 6 weeks | SSE vs SMT | individual 1/week × 6 weeks pressure biofeedback |
| Stuge et al 2004 | pelvic pain > 3 months | SSE + conventional physiotherapy vs conventional physiotherapy (SMT/ modalities/ergonomics) | individual 3/week × 20 weeks not mentioned |

SSE = specific stabilisation exercise, SMT = spinal manipulative therapy, PT = physiotherapy.

of the following outcomes had to be reported: disability, pain, return to work, number of episodes, global perceived effect, or health-related quality of life.

***Identification and selection of trials*** Searches were conducted of MEDLINE (1966 to March 2004), EMBASE (1974 to March 2004), CINAHL (1982 to March 2004), and PEDro (to March 2004). OVID was used to search all databases except PEDro. Terms for OVID searches included a combination of subject headings and text words related to the domains of randomised controlled trials and back pain as described by the Cochrane Back Review Group (van Tulder et al 2003) and [(specific or stabili$ or segment$ or multifidus or transversus or deep neck flexors or pelvic floor).mp and (exercise or train$).mp]. One reviewer (PF) screened search results for potentially eligible studies,
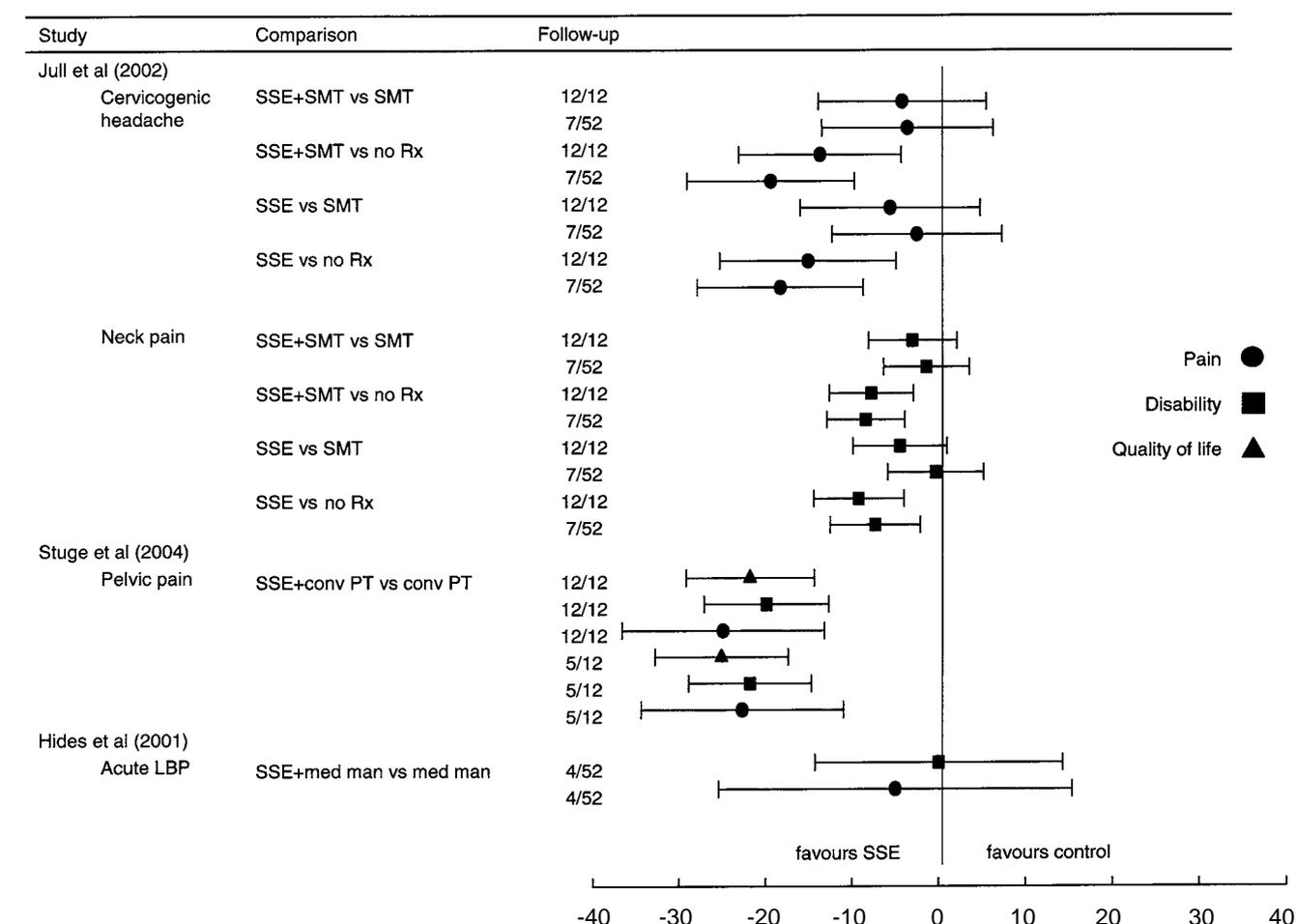
**Figure 1.** Effect of specific stabilisation exercise on pain, disability, and quality of life outcomes for acute LBP, pelvic pain, and cervical pain. Effects are between group differences with 95% CI; each outcome is measured on a 0–100 scale. SSE = specific stabilisation exercises; SMT = spinal manipulative therapy; Rx = treatment; conv PT = conventional physiotherapy; med man = medical management ; 12/12 indicates 12 months; 7/52 indicates 7 weeks; 5/52 indicates 5 weeks.

and two reviewers (PF, MF) independently reviewed papers for eligibility. A third independent reviewer (RH) resolved any disagreement on the inclusion of trials. If the selection criteria were not described clearly (one trial) the author was contacted for clarification. A consensus of the investigators was undertaken if authors could not be contacted. Researchers involved in the area were contacted for trials currently being conducted. Citation tracking was also performed by manually screening reference lists of eligible trials and using the ISI Web of Science to locate studies citing eligible papers.

***Assessment of quality of trials*** The quality of the trials was assessed using the PEDro scale (Maher et al 2003). This scale is based on the Delphi list (Verhagen et al 1998) and assesses the presence or absence of 10 methodological criteria. Trials were excluded from subsequent analyses if a threshold score of three points was not reached. Most trials had already been rated at least twice by trained raters of the PEDro database (www.pedro.fhs.usyd.edu.au). Where trials were not included in PEDro or had not been previously rated twice, they were rated independently by two investigators (PF, MF). Disagreements were resolved by a third rater (RH).

***Analysis of efficacy of treatment***

*Effect size for individual trials* For continuous outcomes we calculated the mean and 95% confidence interval for the between-group difference of either the end points or the change scores (Green et al 2001). When dichotomous data were provided, relative risk (RR) was calculated (Oxman 1994). We used the formulae for binary and continuous data calculations described by Fleiss (Fleiss 1993).

*Effect size for pooled estimates from multiple trials* When trials were considered sufficiently homogeneous they were grouped according to pain location (cervical, thoracic, lumbar, pelvic), outcomes (disability, pain, number of episodes, global perceived effect, return to work), mean duration of symptoms (less than three months for acute pain, three months or longer for chronic pain), and treatment comparisons. Pooled estimates were obtained using a random effects model. Pain, disability, and quality of life scales were converted to 0–100 scales. Individual data were presented following the definition of short (< 3 mo), intermediate (> 3 and < 12 mo), and long term (≥ 12 mo) follow-up proposed by the Cochrane Back Review Group (Van Tulder et al 2003).

Table 2. Methodological quality of trials based on the PEDro 10-point scale.

| Trial | 1<br>Random<br>allocation | 2<br>Concealed<br>allocation | 3<br>Baseline<br>comparability | 4<br>Blind subjects | 5<br>Blind therapists |
|---|---|---|---|---|---|
| Brox et al 2003 | Yes | Yes | Yes | | |
| Cairns et al 2000 | Yes | | Yes | | |
| Goldby et al 2000 | Yes | Yes | Yes | | |
| Hides et al 1996 | Yes | Yes | Yes | | |
| Hides et al 2001 | Yes | | Yes | | |
| Jull et al 2002 | Yes | Yes | Yes | | |
| Kladny et al 2003 | Yes | | Yes | | |
| Koumantakis et al 2003 | Yes | Yes | Yes | | |
| Moseley 2002 | Yes | | Yes | | |
| Niemisto et al 2003 | Yes | Yes | Yes | | |
| O'Sullivan et al 1997 | Yes | Yes | Yes | | |
| Rasmussen-Barr et al 2003 | Yes | | Yes | | |
| Stuge et al 2004 | Yes | | Yes | | |
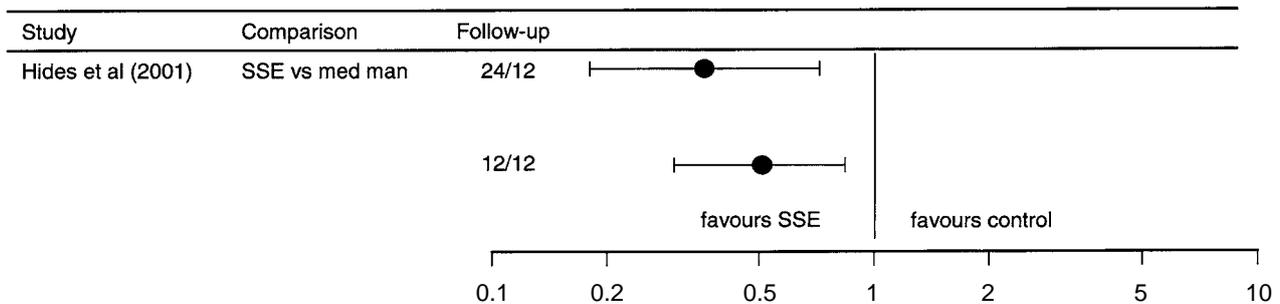


**Figure 2.** Effect of specific stabilisation exercise on risk of recurrence after an acute episode of LBP. Effects are relative risk with 95% CI. SSE = specific stabilisation exercises; med man = medical management.

## Results

***Included trials*** Database searches identified 194 studies; abstracts of 19 studies suggested they were potentially eligible for inclusion, but only 13 met the inclusion criteria and were retained after assessment of quality. Of the 13 included articles two shared data from one trial, giving a total of 12 discrete trials with sufficient data to estimate effect sizes (Table 1). The most commonly-assessed outcomes were pain (12 trials) and disability (12 trials). Quality of life was assessed in two trials (Goldby et al 2000, Niemisto et al 2003) and recurrence in a single trial (Hides et al 2001).

***Quality of trials*** Quality scores ranged from 4 to 8 points out of a maximum of 10 points (mean ± SD, 6.5 ± 1.1) (Table 2). All included trials reached our quality threshold (3 points). The most common problems were failure to blind subjects (all 12 trials), failure to blind therapist (all 12 trials), and failure to conceal allocation (6 trials). Effective blinding of subjects or therapists is difficult or impossible in these trials.

***Efficacy of treatment***

*Cervicogenic headache and associated neck pain* One trial

(Jull et al 2002) (quality score = 8) investigated the effect of specific stabilisation exercise in patients with cervicogenic headache and associated neck pain. Stabilisation exercise alone was compared to no treatment, spinal manipulative therapy, and a combination of specific stabilisation exercise and spinal manipulative therapy. All effects are reported on a 0–100 scale. For neck pain, specific stabilisation exercise was more effective than no treatment in reducing disability in the short term (effect = –7, CI –13 to –2) and long term (effect = –9, CI –14 to –4) (Figure 1), but not more effective than spinal manipulative therapy in reducing disability in the short term (effect = 0, CI –6 to 6) or long term (effect = –5, CI –10 to 1). When added to spinal manipulative therapy, specific stabilisation exercise was more effective than no treatment in reducing disability in the short term (effect = –9, CI –13 to –4) and long-term (effect = –8, CI –13 to –3) but not more effective than spinal manipulative therapy alone in the short term (effect = –1, CI –6 to 4) or long-term (effect = –3, CI –8 to 2). For cervicogenic headache, specific stabilisation exercise was more effective than no treatment in reducing headache pain intensity in the short term (effect = –18, CI –28 to –9) and at 12 months (effect = –15, CI –25 to –5). Specific stabilisation exercise was not more effective than spinal manipulative therapy in reducing

| 6 Blind assessors | 7 Adequate follow-up | 8 Intention-to-treat analysis | 9 Between-group comparisons | 10 Point estimates and variability | Total score |
|---|---|---|---|---|---|
| Yes | Yes | Yes | Yes | Yes | 8 |
| Yes | | Yes | Yes | Yes | 6 |
| Yes | | | Yes | Yes | 6 |
| Yes | Yes | | Yes | Yes | 7 |
| Yes | Yes | | Yes | Yes | 6 |
| Yes | Yes | Yes | Yes | Yes | 8 |
| | | | Yes | Yes | 4 |
| Yes | | Yes | Yes | Yes | 7 |
| Yes | Yes | | Yes | Yes | 6 |
| Yes | Yes | Yes | Yes | Yes | 8 |
| Yes | Yes | | Yes | Yes | 7 |
| Yes | Yes | | Yes | Yes | 6 |
| Yes | Yes | | Yes | Yes | 6 |



**Figure 3.** Effect of specific stabilisation exercise on pain, disability, and quality of life outcomes for chronic LBP. Effects are between group differences with 95% CI; each outcome is measured on a 0–100 scale. SSE = specific stabilisation exercises; SMT = spinal manipulative therapy; GP = general medical practitioner.

headache pain intensity in the short term (effect = –3, CI –12 to 7) or long term (effect = –6, CI –16 to 5). When added to spinal manipulative therapy, specific stabilisation exercise was more effective than no treatment in reducing headache pain intensity in the short term (effect = –19, CI –29 to –10) or long term (effect = –14, CI –23 to –4) but not when compared to spinal manipulative therapy alone in the short (effect = –4, CI –13 to 6) or long term (effect = –4, CI –14 to 6).

*Pelvic pain* One trial (Stuge et al 2004) (quality score = 6) compared specific stabilisation exercise plus a conventional physiotherapy program (modalities, spinal manipulative therapy, and ergonomic advice) to a conventional physiotherapy program alone for patients with pelvic pain. When added to a conventional physiotherapy program specific stabilisation exercise was more effective than conventional physiotherapy alone for all outcomes at both assessment occasions (up to 12 months) with estimates of
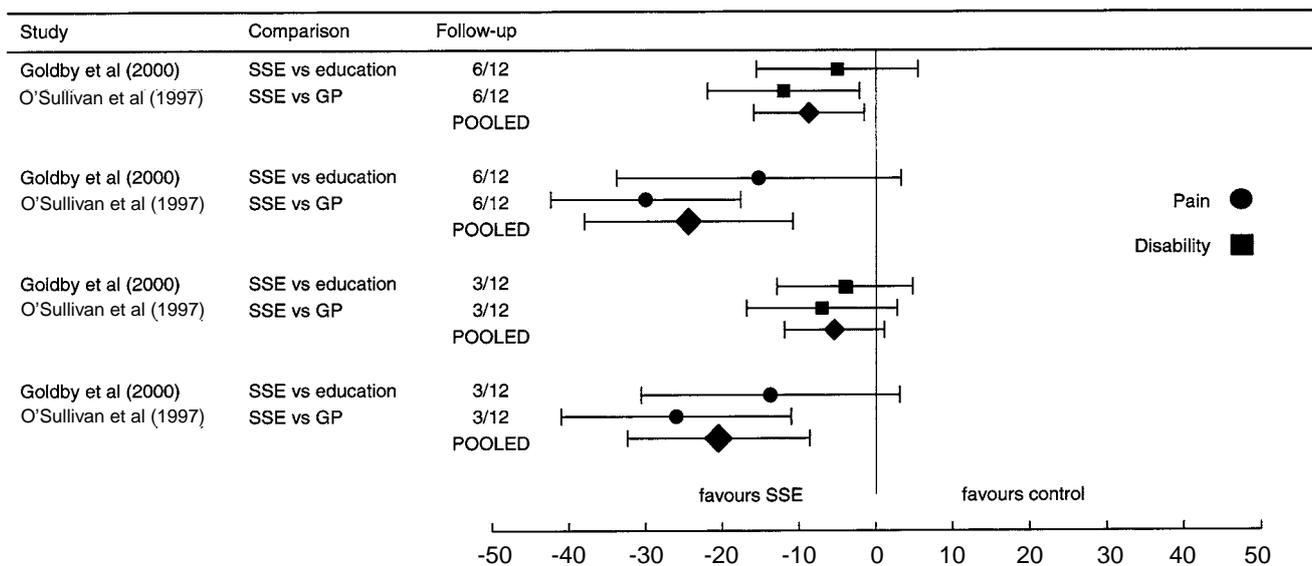
**Figure 4.** Effect of specific stabilisation exercise treatment compared to usual care on pain and disability outcomes for chronic LBP. Effects are between group differences with 95% CI; each outcome is measured on a 0–100 scale. SSE = specific stabilisation exercises; GP = general medical practitioner.
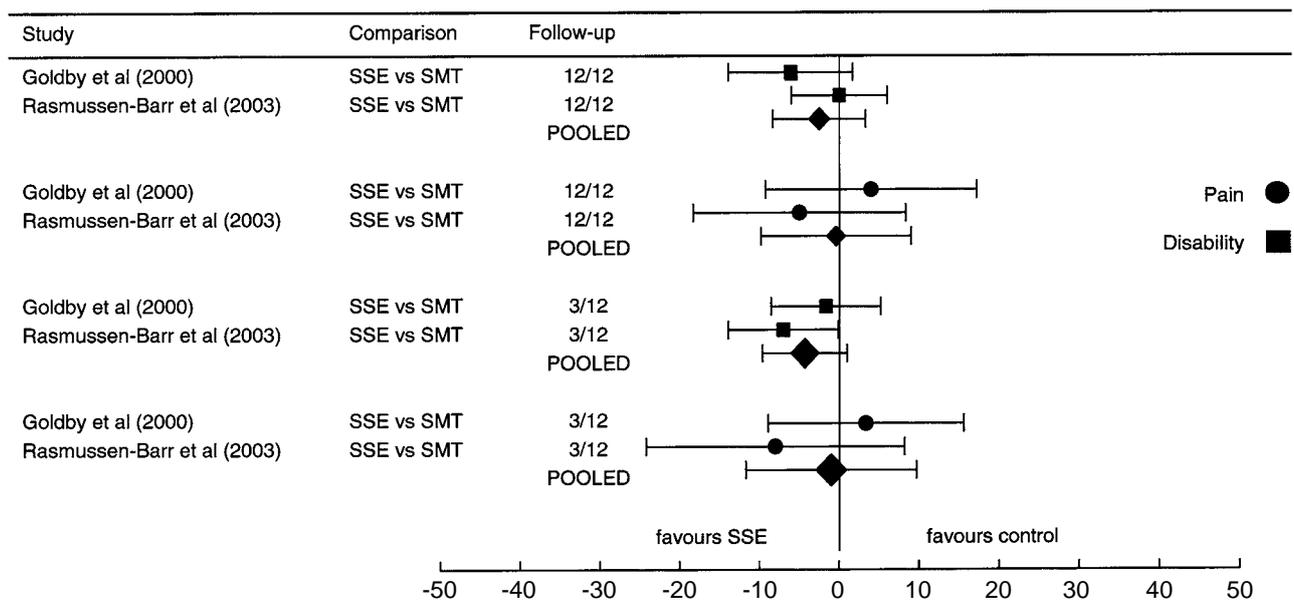


**Figure 5.** Effect of specific stabilisation exercise compared to spinal manipulative therapy for pain and disability outcomes for chronic LBP. Effects are between group differences with 95% CI; each outcome is measured on a 0–100 scale. SSE = specific stabilisation exercises; SMT = spinal manipulative therapy.

effects of 20–27 points (Figure 1).

*Acute low back pain* One trial (Hides et al 1996) (quality score = 7) compared specific stabilisation exercise plus medical management to medical management alone for acute low back pain. There was no effect of specific stabilisation exercise on pain (effect = –5, CI –25 to 15) or disability (effect = 0, CI –14 to 14). However the addition of specific stabilisation exercise to medical management substantially reduced recurrence at 1 year (RR = 0.36, CI 0.18 to 0.72) and 2 years (RR = 0.51, CI 0.30 to 0.84) (Figure 2).

*Chronic low back pain* Two trials compared specific

stabilisation exercise to usual care. O'Sullivan et al (1997) (quality score = 7) examined the effects of specific stabilisation exercise compared to a control group receiving treatment at the discretion of the general practitioner. Goldby et al (2000) (quality score = 6) examined the effects of specific stabilisation exercise compared to an education booklet. Effects and 95% confidence intervals for all follow-ups are given in Figure 3. The pooled analysis (Figure 4) indicated that specific stabilisation exercise was substantially more effective than usual care for reducing pain in the short term (effect = –21, CI –32 to –9) and medium term (effect = –24, CI –38 to –11). Specific stabilisation exercise was not
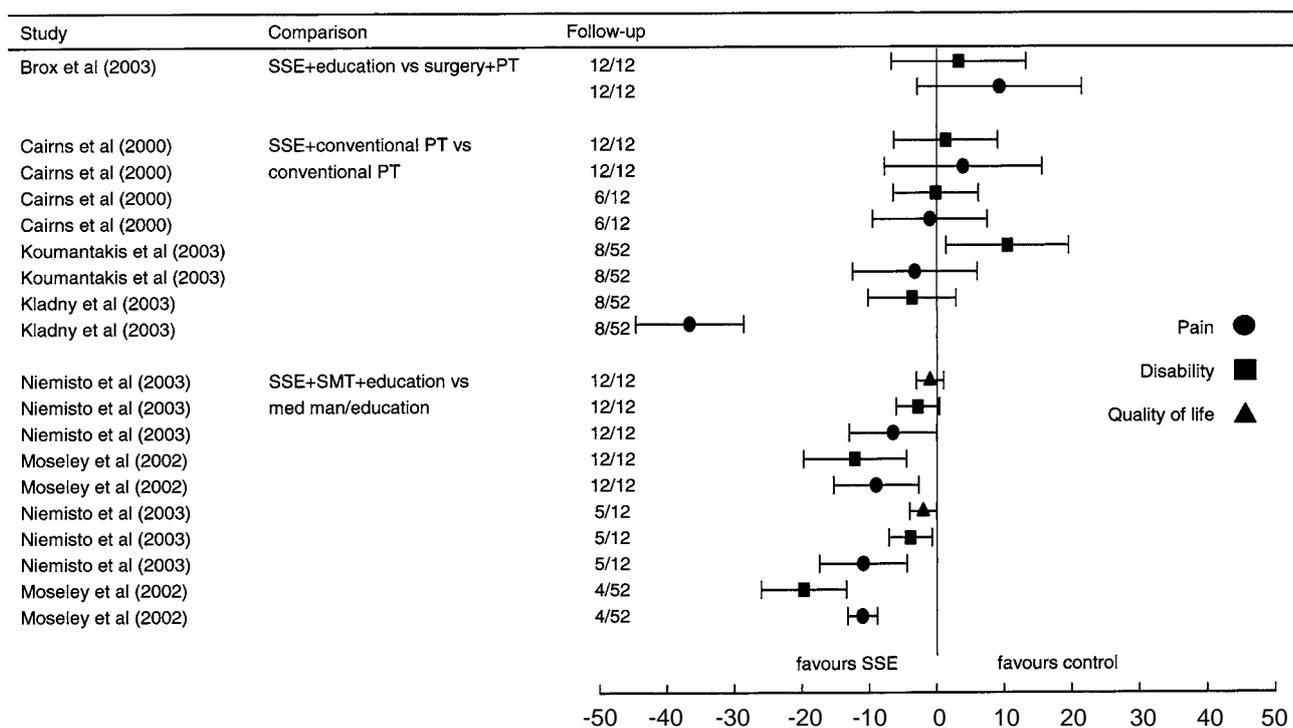
**Figure 6.** Effects of specific stabilisation exercise combined with various interventions on pain, disability, and quality of life outcomes for chronic LBP. Effects are between group differences with 95% CI; each outcome is measured on a 0–100 scale. SSE = specific stabilisation exercises; PT = physiotherapy; SMT = spinal manipulative therapy; med man = medical management.

more effective than usual care for reducing disability in the short term (effect = –5, CI –12 to 1) but was more effective in the medium term (effect = –9, CI –16 to –2).

Two trials (Goldby et al 2000, Rasmussen et al 2003) (quality score = 6) examined the effect of specific stabilisation exercise compared to spinal manipulative therapy (Figure 3). The pooled analysis indicated that specific stabilisation exercise produced reductions in pain or disability that were similar to spinal manipulative therapy at short- and long-term follow-up (Figure 5).

Two trials (Moseley 2002, Niemisto et al 2003) (quality scores = 6 and 8) examined the effect of specific stabilisation exercise as part of a physiotherapy treatment program (combined with spinal manipulative therapy and education) compared to either education (Niemisto et al 2003) or medical management (Moseley 2002). Physiotherapy treatment including specific stabilisation exercise was more effective than medical management or education for reducing pain and disability in the short term (effect on pain = –11, CI –13 to –9, effect on disability = –20, CI –27 to –13) (Moseley 2002), and medium-term (effect on pain = –11, CI –18 to –5, effect on disability = –4, CI –7 to –1) (Niemisto et al 2003) (Figure 6). In the long-term, physiotherapy treatment that included specific stabilisation exercise was more effective than medical management for reducing pain and disability (effect on pain = –9, CI –15 to –3, effect on disability = –12, CI –20 to –5) (Moseley 2002), more effective than education for reducing pain (effect = –7, CI –13 to 0), but not disability (effect = –3, CI –6 to 0) (Niemisto et al 2003). Physiotherapy treatment including specific stabilisation exercise marginally improved quality

of life when compared to education in the medium-term (effect = –2, CI –4 to 0) but not long-term (effect = –1, CI –3 to 1) (Niemisto et al 2003). One trial (Brox et al 2003) (quality score = 8) examined the effect of specific stabilisation exercise and education compared to surgery (spinal fusion) and physiotherapy treatment (advice and exercise) for patients with disc degeneration. Both groups experienced similar reductions in pain (effect = 9, CI –4 to 22) and disability (effect = 3, CI –7 to 13) at long-term follow up.

Three trials (Cairns et al 2000, Kladny et al 2003, Koumantakis et al 2003) (quality scores = 6, 4 and 7) examined the effect of specific stabilisation exercise added to conventional physiotherapy treatment that included spinal manipulative therapy and stretching (Kladny et al 2003), spinal manipulative therapy, modalities, and exercise (Cairns et al 2000), and general exercise (Koumantakis et al 2003) compared to conventional physiotherapy treatment alone (Figure 6). The pooled analysis indicated that conventional physiotherapy supplemented with specific stabilisation exercise produced similar reductions in pain or disability to conventional physiotherapy alone at short-term follow up (Figure 7).

## Discussion

Overall this review provides some evidence that specific stabilisation exercise produces modest beneficial effects for people with spinal and pelvic pain. However, different effects were obtained when different types of spinal pain and comparison treatments were analysed. Specific stabilisation exercise was, in general, superior to no treatment or to
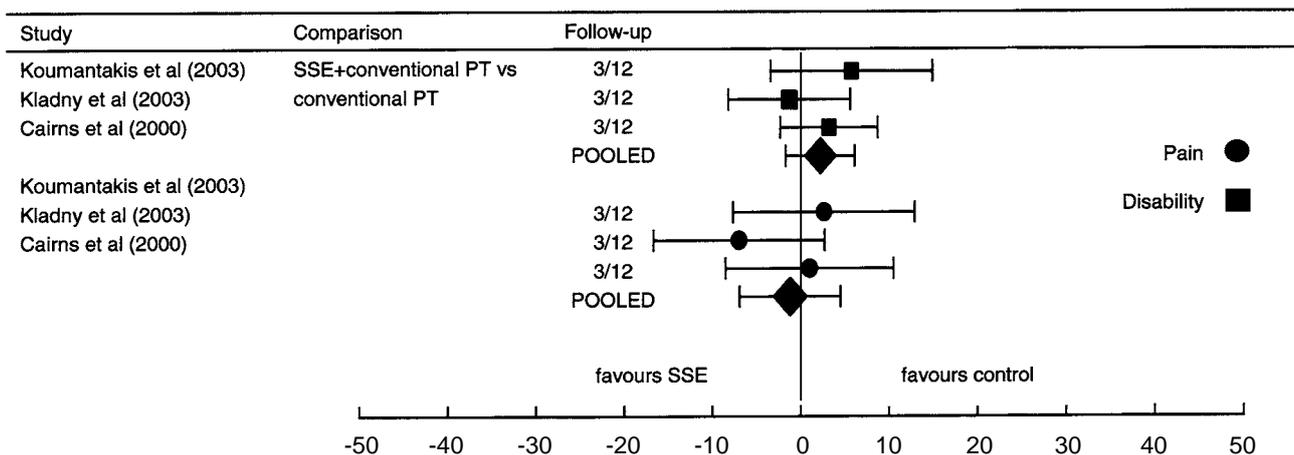
**Figure 7.** Effect of specific stabilisation exercises combined with a conventional physiotherapy program versus conventional physiotherapy alone on pain and disability outcomes for chronic LBP. Effects are between group differences with 95% CI; each outcome is measured on a 0–100 scale. SSE = specific stabilisation exercises; PT = physiotherapy; SMT = spinal manipulative therapy.

treatments such as usual care and education, but the effects of specific stabilisation exercise did not appear to be any greater than effects of spinal manipulative therapy or conventional physiotherapy programs.

A single trial revealed that patients suffering from cervicogenic headache and neck pain would probably benefit from specific stabilisation exercise. However, spinal manipulative therapy appears to offer similar effects. Whether the two interventions have a common pathway or whether different patients have features that cause them to respond to one intervention better than another still remains unanswered. We did not identify any study examining the effects of specific stabilisation exercise in non-specific neck pain.

Only one trial examined specific stabilisation exercise for patients with pelvic pain after pregnancy (Stuge et al 2004). Specific stabilisation exercise plus a conventional physiotherapy program (modalities, spinal manipulative therapy, and ergonomic advice) was more effective than a conventional physiotherapy program alone in reducing pain, disability and increasing quality of life. After running the search strategy and retrieving trials, we became aware that the same authors had published two-year follow up results which showed that the effects were maintained (Stuge et al 2004). Additional clinical trials are required to confirm the efficacy of specific stabilisation exercise for this condition.

Specific stabilisation exercise was not effective in reducing pain or disability for acute low back pain. This finding is in accordance with those from previous systematic reviews of exercise for acute low back pain (van Tulder et al 2000a). Patients with acute low back pain probably benefit from interventions such as spinal manipulative therapy, which are more specifically designed to alleviate pain (Ferreira et al 2003). However, there is some evidence that specific stabilisation exercise is effective in reducing recurrence after an acute episode of low back pain. Therefore clinicians could consider prescribing specific stabilisation exercise for acute low back pain to reduce future recurrences, but not with the aim of reducing pain or disability.

Chronic low back pain has been regarded as a problematic condition with a low treatment success rate (Waddell 1998). However, our review demonstrated that specific stabilisation exercise can be helpful in the management of chronic low back pain. Although some of the randomised controlled trials included in the present review might have small and heterogeneous low back pain samples, this finding is in accordance with other reviews which suggest that active interventions such as exercise (van Tulder et al 2000a) and cognitive behavioural therapy (van Tulder et al 2000b) are effective. One question that remains to be answered is whether specific stabilisation exercise is superior to other forms of exercise. From a theoretical point of view, specific stabilisation exercise should be targeted at individuals suffering from low back pain with signs of alteration in recruitment of the deep spinal muscles. Even though one of our specific analyses showed that specific stabilisation exercise was not more effective than spinal manipulative therapy, our pooled analysis showed that specific stabilisation exercise is more effective than other treatments such as an education booklet or treatment by a general practitioner. The review also found that a brief period of specific stabilisation exercise combined with education offered similar effects to surgery (spinal fusion) for patients with disc degeneration. This is an interesting result especially considering the lower costs involved with the application of exercise compared to a surgical procedure.

In summary, based on the available evidence, it appears that specific stabilisation exercise reduces pain and disability in chronic but not acute low back pain. Single trials provide preliminary evidence that specific stabilisation exercise also appears to be helpful for the treatment of cervicogenic headache, neck pain, and pelvic pain, as well as for decreasing recurrence of low back pain after an acute episode. However, it is not clear whether these improvements in pain and disability are associated with changes in the pattern of muscle activation, and therefore whether the theory underpinning this treatment regimen can be substantiated. Nevertheless, our review suggests that specific stabilisation exercise is an effective treatment option for many forms of spinal pain.

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