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Bibliographic Data	
Authors	Saragiotto BT, Maher CG, Yamato TP, and et al.
Title	Motor control exercise for chronic non-specific low-back pain.
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Other information if relevant	

Methods	
Aim of study	To evaluate the effectiveness of motor control exercise (MCE) in patients with chronic non-specific low back pain (LBP).
Design	Meta-analyses of randomized clinical trials

PICOS	
Population from which participants are drawn	Adults recruited from primary or tertiary care reporting chronic, non-specific CLBP that persisted for 12 weeks or more and was not associated with pathological entities.
Intervention being evaluated	MCE intervention focuses on the activation and training of the deep and global trunk muscles and targets the restoration, activation, and control and co-ordination of these muscles that control and support the spine such as the multifidus and transversus abdominis. Patients are taught how to contract trunk muscles in a specific manner, starting with static activities and progressing to dynamic and more complex tasks including specific stabilization exercises.
Comparison or control intervention	Placebo, no treatment, another active treatment, or when MCE was added as a supplement to other interventions and comprised at least 50% of the total treatment program. Active treatments included other exercises or manual therapy.
Outcomes	Primary outcomes were pain intensity and disability. The secondary outcomes were function, quality of life, global impression of recovery, return to work, adverse events and recurrence. All outcomes must have been measured with a valid and reliable instrument.

Study types	Randomized controlled trials, excluding trials with quasi-random allocation procedures

Study selection	
Search date of literature review	April 2015
Databases in literature search	EMBASE, MEDLINE, CENTRAL, CINAHL, SPORTDiscus (EBSCO), Physiotherapy Evidence Database (PEDro), Latin American and Caribbean Health Sciences Literature (LILACS), ClinicalTrials.gov, World Health Organization International Clinical Trials Registry Platform (WHO ICTRP), and PubMed were the computerized databases; the authors also did some hand searching of reference lists of previous reviews
How authors assessed study quality (risk of bias and other considerations	Cochrane risk of bias tool using the 12 criteria recommended by the Cochrane Back and Neck Review Group. A low risk of bias was defined as studies fulfilling 6 or more of the 12 internal validity criteria, and high risk met fewer than 6 criteria. GRADE (Grades of Recommendation, Assessment, Development and Evaluation) profiles were used to evaluate the overall quality of the evidence and the strength of the recommendations.
Additional information if relevant	The clinical relevance of each of the pooled results was also assessed.

Results	
Number of studies screened	2055 records were screened
Number of studies selected for analysis of results	29 RCTS were selected with 2431 participants. Included studies were published between 2003 and 2015. Study sample sizes ranged from 20 to 323 participants.

Whether authors elected to perform meta-analysis to pool study results statistically and type of meta-analysis done (fixed effect or random effects, heterogeneity, etc)	If studies were clinically homogeneous regarding study population, types of treatment, outcomes and measurement instruments, a fixed effect meta-analysis was performed. If substantial heterogeneity $I^2 > 50\%$ was present, studies were not pooled, but results were described in the text. When I^2 values were slightly higher than 50%, and no clear heterogeneity by visual inspection was identified, the results were combined into a meta-analysis using a random-effects model, and the evidence was downgraded for inconsistency in the quality of evidence assessment. In total, 29 comparisons were made, each comparison divided into 3 time points (short-term < 3 months, intermediate $\geq$ 3 to 12 months, and long term > 12 months) where results were pooled and a meta-analysis was performed. For continuous outcomes, mean differences (MD) and 95% confidence intervals (CIs) were calculated for each analysis. For dichotomous variables, risk ratios (RR) and odds ratios (OR) with 95% confidence intervals (CIs) were used to calculate treatment effects.
Quality of studies as assessed by authors	A total of 76.6% of the included trials had a low risk of bias, which included 86% of all participants (n = 2088). Twenty-four trials met the criteria for adequate randomization and 13 for allocation concealment. A total of 14 trials attempted to blind the outcome assessor, but the patients were not blinded. 15 trials provided adequate information about missing data and kept this below 20% for short and intermediate-term, or 30% for long-term outcomes. Published protocols or registered trials were available for 8 trials. The examination of publication bias with funnel plots was possible for only one comparison, MCE versus other exercises, for pain and disability and indicates possible publication bias.

Effect sizes reported for primary outcomes (mean differences, standardized mean differences, response ratios, etc)	- Pooled data from 13 trials (872 participants) showed there was no clinically important effect of motor control exercise (MCE) for reducing pain at short-term (mean difference (MD) -7.53; 95% CIs -10.54 to -4.52) compared with other exercises. Pooled data from 6 trials (588 participants) at intermediate term (MD -2.98; 95% CIs -6.96 to 0.99), and 5 studies (643 patients) at long-term follow-up (MD -2.69; 95% CIs -6.90 to 1.53) showed there was no statistically significant difference or clinically important effect of MCE on reducing pain compared with other exercises. - Pooled data from 11 trials (794 participants) showed there was no clinically important effect of motor control exercise (MCE) for improving disability at short-term (MD -4.82; 95% CIs -6.95 to -2.68) compared with other exercises. Pooled data from 6 trials (588 participants) at intermediate term (MD -2.88; 95% CIs -6.92 to 1.15), and 4 studies (570 patients) at long-term follow-up (MD -0.71; 95% CIs -4.87 to 3.45) showed there was no statistically significant difference or clinically important effect of MCE compared with other exercises for improving disability. - Pooled data from 3 trials (282 participants) at short-term (MD -4.36; 95% CIs -9.52 to 0.81), and 4 trials (485 participants) at intermediate term (MD -7.05; 95% CIs -14.20 to 0.11), and 4 studies (406 patients) at long-term follow-up (MD -3.67; 95% CIs -9.28 to 1.94) showed there was no statistically significant difference or clinically important effect of MCE on reducing pain compared with manual therapy. - Pooled data from 3 trials (282 participants) at short-term (MD -2.79; 95% CIs -6.60 to 1.02), 4 trials (485 participants) at intermediate term (MD -3.28; 95% CIs -6.97 to 0.40), and 4 studies (406 patients) at long-term follow-up (MD -3.40; 95% CIs -7.87 to 1.07) showed there was no statistically significant difference or clinically important effect of MCE compared with manual therapy for improving disability. - Pooled data from 4 trials (291 participants) at short-term (MD -10.01; 95% CIs -15.67 to -4.35), and 4 trials (348 participants) at intermediate term (MD -12.61; 95% CIs -20.53 to -4.69), and 3 studies (279 patients) at long-term follow-up (MD -12.97; 95% CIs -18.51 to -7.42) showed there were statistically significant differences, but no clinically important effects of MCE on reducing pain compared with minimal intervention. - Pooled data from 5 trials (332 participants) at short-term (MD -8.63; 95% CIs -14.78 to -2.47), 4 trials (348 participants) at intermediate term (MD -5.47; 95% CIs -9.17 to -1.77), and 3 studies (279 patients) at long-term follow-up (MD -5.96; 95% CIs -9.81 to -2.11) showed there were statistically significant differences, but no clinically important effects of MCE compared with minimal intervention for improving disability.

Effect sizes reported for additional outcomes (mean differences, standardized mean differences, response ratios, etc)	Only low quality evidence was presented for the secondary outcomes of function, quality of life, global impression of recovery, return to work, adverse events and recurrence.
Additional information if relevant –summary of results	Motor control exercises are at least as effective as general exercises and manual therapy, and may be more effective than minimal interventions for pain reduction and improving disability at all time points.

Authors' Conclusions	
Key conclusions of study authors	- This review found that motor control exercises had a clinically important effect compared with a minimal intervention for chronic low back pain. MCE provides similar outcomes of pain reduction and improved disability as manual therapies and other forms of exercises for all follow-up periods. This review did not find clinically important effects for pain and disability for MCE compared with other exercises, or manual therapy, although most treatment effects were in favor of MCE. - Given the evidence that MCE is not superior to other forms of exercise, the choice of exercise for chronic LBP should probably depend on patient or therapist preferences, therapist training, costs and safety. - Minor or no adverse events were reported in the included trials. - All the results were consistent with a sensitivity analysis of high quality trials, which suggests that the inclusion of low quality trials did not introduce bias that would overestimate the effect estimates of MCE. - There was some small variability in the populations included, but we do not believe that it would affect the generalizability of the findings. - Study quality was mostly downgraded due to inconsistency and imprecision, that is related to high heterogeneity and insufficient pooled sample size. - Future randomized controlled trials in chronic non-specific low back pain should include more complete descriptions of the exercise interventions, so that interpretation of the results would be more transparent. It is strongly recommend that future trials have adequate sample size.
Additional information if relevant	

Comments by DOWC staff

- Even though the pooled effect estimates of pain comparing MCE with minimal intervention for all 3 follow-up periods (-10.01, -12.61, -12.97) did not reach the minimal clinically important difference for pain, one cannot discard an important clinical effect for pain at all follow-up periods, as the confidence intervals do include clinically important effect sizes (-15.67 to -4.35, -20.53 to -4.69, and-18.51 to -7.42).
- This review did not find a clinically important effect for MCE compared with other exercises and manual therapy which is consistent with previous version of this review (Macedo 2009) and the most recent systematic review on the topic (Bystrom 2013).
- Even though 76.6% of the included studies were classified by the authors as having a low risk of bias (scoring at least 6 of 12 points), half of the studies scored between 6 and 7, which is just barely over the limit for classification as low risk of bias. It seems the authors may have overestimated the number of included studies that truly had a low risk of bias.
- A limitation of this review is the presence of possible publication bias in the 2 comparisons assessed with funnel plots. For most comparisons it was not possible to assess publication bias using the funnel plots as too few studies were included.
- The authors downgraded the quality of meta-analyses for inconsistency if I^2 values were > 50%. This cutoff may be a bit overly stringent resulting in evaluations that may not appropriately reflect the quality of the analyses. Several analyses were rated as low quality for inconsistency with I^2 values between 50 and 60%.
- Future studies should include larger studies in order to reduce wide confidence intervals resulting in nonsignificant results. If larger studies had been included in the pooled analyses, perhaps more conclusive results would have been found.

Assessment by DOWC	
Overall assessment as suitability of evidence for the guideline ☒ High quality ☐ Adequate ☐ Inadequate	High quality Cochrane meta-analysis supporting strong evidence that in the short, intermediate, and long-term, motor control exercises, emphasizing the transversus abdominis and multifidi, are at least as effective as other forms of exercise and manual therapy, and possibly more effective than other minimal interventions in reducing pain and improving disability in patients for the treatment of chronic non-specific low back pain.
If inadequate, main reasons for recommending that the article not be cited as evidence	

Additional references if relevant

- Bystrom MG, Rasmussen-Barr E, Grooten WJA. Motor control exercises reduces pain and disability in chronic and recurrent low back pain. *Spine* 2013;**38**:E350–8.