



A randomized clinical trial comparing the McKenzie method and motor control exercises in people with chronic low back pain and a directional preference: 1-year follow-up

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Abstract

Objective The primary objective of this study was to compare the long-term (1-year follow-up) effects of the McKenzie method and motor control exercises on trunk muscle thickness in people with chronic low back pain (LBP) and a directional preference.

Design Randomized controlled trial.

Setting A secondary public health facility in Sydney, Australia.

Participants Seventy adults with greater than 3-month history of LBP and a directional preference.

Interventions Participants were randomized to receive 12 treatments of either the McKenzie method or motor control exercises over 8-weeks.

Outcome measures Muscle thickness of the transversus abdominis, obliquus internus, and obliquus externus measured from ultrasound images. Secondary outcomes included function, perceived recovery, and pain. Outcomes were collected at baseline, post intervention at 8-weeks, and at 1-year follow-up by blinded assessors. The current paper focuses on the 1-year follow-up.

Results Fifty-eight participants completed data collection for the primary outcome at 1-year. There were no significant between group differences for changes in trunk muscle thickness for any of the three investigated muscles: transversus abdominis [3%, 95% confidence interval (CI): -5%, 11%], obliquus internus [-4%, 95% CI: -9%, 2%] and obliquus externus [3%, 95% CI: -4%, 11%]. Similarly, there were no significant differences between groups for the secondary outcomes of function, perceived recovery and pain.

Conclusion Trunk muscle thickness, function, perceive recovery and pain are similar between patients receiving McKenzie method or motor control exercises at a 1-year follow-up in a population of people with chronic LBP and a directional preference.

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Keywords: Mechanical Diagnosis and Therapy; Core stability; Trunk muscle recruitment; Ultrasound

Introduction

The McKenzie method or Mechanical Diagnosis and Therapy (MDT) is a classification based, symptom response,

exercise approach for the management of musculoskeletal conditions such as low back pain (LBP) [1]. The mechanism of action for MDT is currently unclear; previously the dynamic disc model has been proposed as a mechanism of action [1], however, this has subsequently been challenged [2]. Alternatively, impaired motor control has been proposed as a mechanism for developing LBP [3,4]. Evidence sug-

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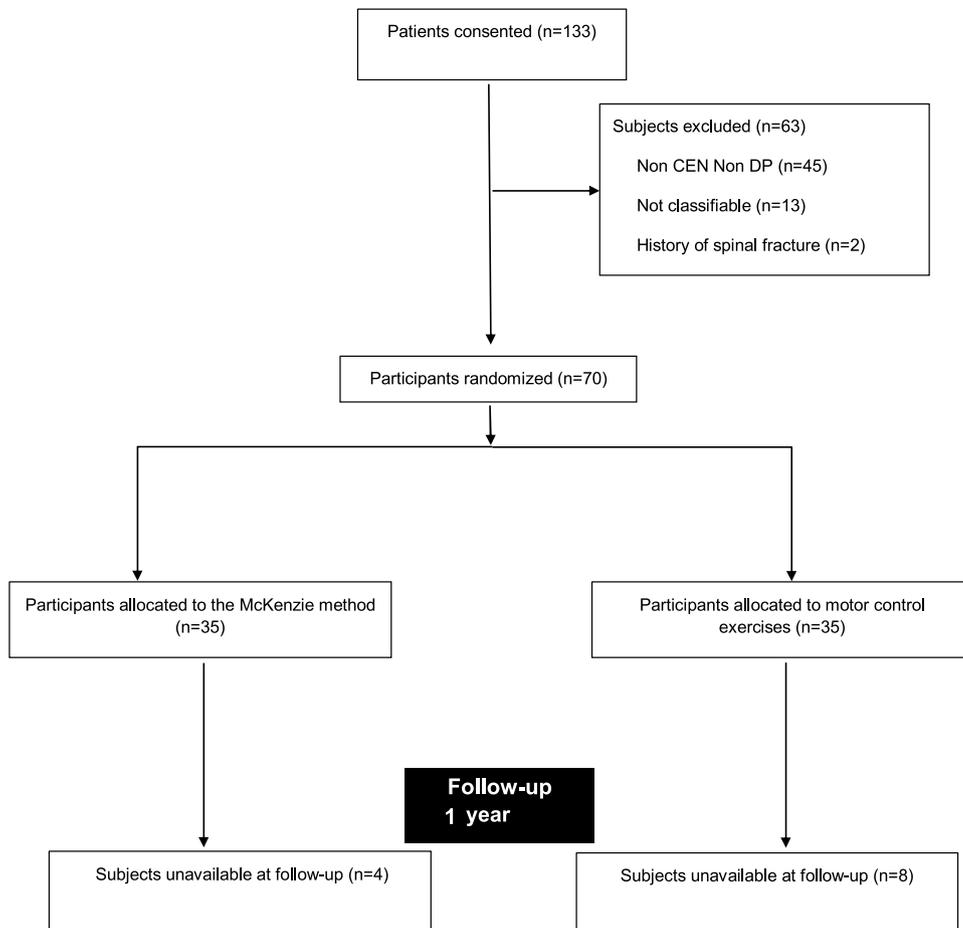


Fig. 1. Trial flow chart.

gests that improved trunk muscle recruitment can lead to better motor control in the short term which is associated with improved clinical outcomes for LBP [5,6]. However, it is unclear if improvements in trunk muscle recruitment are specific to motor control exercises or improve as pain and disability resolve in response to other approaches such as MDT. The authors previously published findings from a RCT showing no difference in trunk muscle recruitment at 8-weeks between patients randomised to MDT or motor control exercises [7]. There is a lack of available evidence on the comparative physiological and clinical outcomes of MDT and motor control exercises in the long-term.

The purpose of this trial was to compare the long-term (1-year follow-up) effects of MDT and motor control exercises on trunk muscle recruitment, function, global perceived recovery and pain in people with chronic LBP and a directional preference [8] (Fig. 1).

Methods

The authors conducted a randomized controlled trial comparing MDT to motor control exercises in patients with

chronic LBP. Full details of the trial have been previously published including the 8-weeks outcomes [7,8]. This paper reports the 1-year outcomes. Ethics approval was granted by the Sydney Local Health District Human Ethics Committee. Seventy adults were recruited with greater than 3-month history of LBP and a directional preference. Exclusion criteria included: under 18 or over 70 years of age, inadequate comprehension of English, metastatic disease, previous spinal fracture or surgery, osteoporosis, and pregnancy. Participants were randomized to either twelve treatments of MDT or motor control exercises over 8-weeks delivered on an individual basis by trained therapists [8].

The primary outcome was trunk muscle thickness, facilitated by automatic recruitment maneuvers measured from ultrasound images expressed as a percentage change in muscle thickness from baseline to 1-year follow-up for the transversus abdominis (TrA), obliquus internus (OI) and obliquus externus (OE). Secondary outcomes included: function measured with the Patient Specific Functional Scale (3–30) [9], perceived recovery recorded with the Global Perceived Effect questionnaire (–5 to 5) [10] and pain using an 11-point visual analog scale. A detailed narrative of the procedures for assessing directional preference, facilitation

Table 1
Mean values (standard deviations) for trunk muscle thickness change, function, perceived recovery and pain at one year.

Variable	McKenzie method (<i>n</i> = 35) (95% CI) from paired sample t test	Motor control exercises (<i>n</i> = 35) (95% CI) from paired sample t test	Between-group difference (95% CI) from regression model adjusted for baseline values*	p Values
Transversus abdominis (%) <i>n</i> = 58				
Baseline	19.7 (19.5)	24.6 (25.4)	3.4 (−4.6 to 11.3)	0.40
Follow-up	21.1 (16.4)	19.4 (17.3)		
Mean change (95% CI)	1.4 (−5.5 to 8.3)	−5.2 (−14.3 to 4.0)		
Obliquus internus (%) <i>n</i> = 58				
Baseline	7.5 (17.6)	11.8 (21.3)	−3.8 (−9.3 to 1.6)	0.16
Follow-up	1.8 (11.5)	7.3 (13.7)		
Mean change (95% CI)	−5.7 (−11.1 to −0.2)	−4.5 (−11.1 to 2.1)		
Obliquus externus (%) <i>n</i> = 58				
Baseline	5.6 (11.2)	6.7 (11.3)	3.4 (−4.3 to 11.1)	0.38
Follow-up	9.1 (17.1)	6.0 (11.6)		
Mean change (95% CI)	3.5 (−3.7 to 10.7)	−0.70 (−5.5 to 4.1)		
PSFS (3 to 30) <i>n</i> = 63				
Baseline	12.4 (4.4)	11.2 (4.4)	0.7 (−1.9 to 3.2)	0.60
Follow-up	23.0 (5.3)	22.4 (4.6)		
Mean change (95% CI)	10.6 (7.9 to 13.3)	11.2 (9.1 to 13.2)		
GPE (−5 to 5) <i>n</i> = 64				
Baseline	−0.9 (3.0)	−0.8 (2.3)	0.4 (−1.1 to 3.8)	0.35
Follow up	3.0 (1.5)	3.4 (1.4)		
Mean change (95% CI)	3.9 (2.8 to 5.1)	4.2 (3.3 to 5.2)		
Pain (0 to 10) <i>n</i> = 64				
Baseline	4.6 (2.2)	5.4 (2.1)	0.5 (−0.6 to 1.7)	0.37
Follow up	2.4 (2.4)	2.1 (2.4)		
Mean change (95% CI)	−2.2 (−3.2 to −1.1)	−3.3 (−4.2 to −2.3)		

Abbreviations: PSFS, Patient Specific Functional Scale; GPE, Global Perceived Effect; VAS, visual analogue scale.

Note: transversus abdominis, obliquus internus and obliquus externus data reflect relative change in muscle thickness from resting to *contracted* state.

of automatic recruitment of the trunk muscles, ultrasound imaging and muscle thickness measurement is described elsewhere [8].

A power analysis was conducted *a priori* and determined a sample size of 70 would provide 80% power for detecting a 7% difference between groups for TrA muscle thickness which is a clinically important difference in the short-term [5]. These calculations assume a loss to follow-up of 10%. Group differences were assessed with linear regression models adjusted for baseline values. There were no adjustments for any other covariates.

Results

Both groups were homogenous for demographics, mechanical characteristics, symptom duration and treatment attendance which has been described in detail previously [7]. Fifty-eight participants returned to the physiotherapy department and completed data collection for the primary outcome of trunk muscle thickness at 1-year while 64 participants provided data for the secondary outcomes. There were no significant between group differences for changes in trunk muscle thickness for the TrA [3%, 95% CI: −5%, 11%],

OI [−4%, 95% CI: −9%, 2%] and OE [3%, 95% CI: −4%, 11%]. Similarly, there were no significant between group differences for the secondary outcomes for function, perceived recovery and pain (Table 1).

Discussion

MDT and motor control exercises appear to produce similar physiological effects on trunk muscle thickness for the TrA, OI, and OE muscles in patients with chronic LBP and a directional preference at a 1-year follow-up. Furthermore, the authors found no significant between group differences for the clinical outcomes of function, perceived recovery and pain. These results suggest that change in muscle thickness may not be as important a contributor to clinical outcomes as previously considered. Therefore, patients and clinicians could consider using either approach to improve long term clinical outcomes in this population.

It is possible the null finding was a result of reduced power as the authors based power calculations on a 10% loss to follow-up, but the authors experienced a 17% loss to follow-up for the primary outcome. However, none of the point estimates for between group muscle thickness were

close to our predetermined clinically important difference of 7% (greatest difference was 4%) and the confidence intervals were relatively small (Table 1), so the authors believe that the findings for trunk muscle thickness are due to lack of effect rather than low statistical power.

Institutional review board

The study protocol was approved by the Sydney Local Health District Human Ethics Committee.

Trial registration

The trial was registered with the Australian New Zealand Clinical Trials Registry, registration number: CTRN12611000971932.

Ethics approval: Ethics approval was granted by the Sydney Local Health District Human Ethics Committee HREC/10/CRGH/153.

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Conflict of interest: Helen Clare is currently Chief Executive Officer of the McKenzie Institute International and was previously Director of the teaching faculty for the McKenzie Institute International at the commencement of this project.

References

- [1] McKenzie RA, May S. *The Lumbar Spine Mechanical Diagnosis & Therapy*. 2nd ed. Spinal Publications New Zealand Ltd; 2003.
- [2] Abdollah V, Parent EC, Battié MC. MRI evaluation of the effects of extension exercises on the disc fluid content and location of the centroid of the fluid distribution. *Musculoskelet Sci Pract* 2018;33:67–70.
- [3] Ferreira PH, Ferreira ML, Hodges PW. Changes in recruitment of the abdominal muscles in people with low back pain: ultrasound measurement of muscle activity. *Spine (Phila Pa 1976)* 2004;29(22):2560–6.
- [4] Pulkovski N, Mannion AF, Caporaso F, Toma V, Gubler D, Helbling D, et al. Ultrasound assessment of transversus abdominis muscle contraction ratio during abdominal hollowing: a useful tool to distinguish between patients with chronic low back pain and healthy controls? *Eur Spine J* 2012;21:S750–9.
- [5] Ferreira PH, Ferreira ML, Maher CG, Refshauge K, Herbert RD, Hodges PW. Changes in recruitment of transversus abdominis correlate with disability in people with chronic low back pain. *Br J Sports Med* 2010;44(16):1166–72.
- [6] Vasseljen O, Fladmark AM. Abdominal muscle contraction thickness and function after specific and general exercises: a randomized controlled trial in chronic low back pain patients. *Man Ther* 2010;15(5):482–9, <http://dx.doi.org/10.1016/j.math.2010.04.004>.
- [7] Halliday MH, Pappas E, Hancock MJ, Clare HA, Pinto RZ, Robertson G, et al. A randomized controlled trial comparing the mckenzie method to motor control exercises in people with chronic low back pain and a directional preference. *J Orthop Sports Phys Ther* 2016;46(7):514–22 <https://doi.org/10.2519/jospt.2016.6379>.
- [8] Halliday MH, Ferreira PH, Hancock MJ, Clare HA. A randomized controlled trial comparing mckenzie therapy and motor control exercises on the recruitment of trunk muscles in people with chronic low back pain: a trial protocol. *Physiotherapy* 2015;101(2):232–8.
- [9] Stratford PW, Gill C, Westaway MD, Binkley JM. Assessing disability and change on individual patients a report of a patient specific measure. *Physiother Can* 1995;47(9):258–63.
- [10] Kamper SJ, Ostelo RW, Knol DL, Maher CG. Global Perceived Effect scales provided reliable assessments of health transition in people with musculoskeletal disorders, but ratings are strongly influenced by current status. *J Clin Epidemiol* 2010;63(7):760–6.

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