

The effectiveness of Technology-supported exercise therapy for low back pain: A Systematic review

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Background

Exercise therapy is commonly used as the treatment of choice in the rehabilitation of low back pain (LBP). Despite the positive effects on pain and disability, not all patients benefit from this type of treatment and the effect sizes are only small to moderate. In recent years, technological systems have been introduced to support exercise therapy. However, it remains unknown whether this has led to better treatment results.

Aim

- To provide an overview of the available technological systems supporting exercise therapy for LBP that have been evaluated in randomized controlled trials;
- To assess the effectiveness of technology-supported exercise therapy (TSET) in patients with LBP, compared to other interventions, placebo or no treatment.

Methods

Search strategy

A systematic computerized search was performed up until July 2014 in the following databases: Pubmed, PEDro, EMBASE, Cochrane central register of controlled trials (CENTRAL), IEEE, and ACM.

Eligibility Criteria

Study Design	Randomized controlled trials
Subjects	Adults with LBP of musculoskeletal origin
Interventions	Technology-supported exercise therapy Technology had to be used simultaneously with the exercises Technology with an electronical component
Comparisons	Other interventions, placebo or no intervention
Outcomes	Pain, disability or muscle function

Risk of bias

Risk of bias was assessed independently by two reviewers (T.M. and A.T.) using a 12-item checklist [1]. A study was categorized as having a low risk of bias if it had six or more positive items and no major flaws

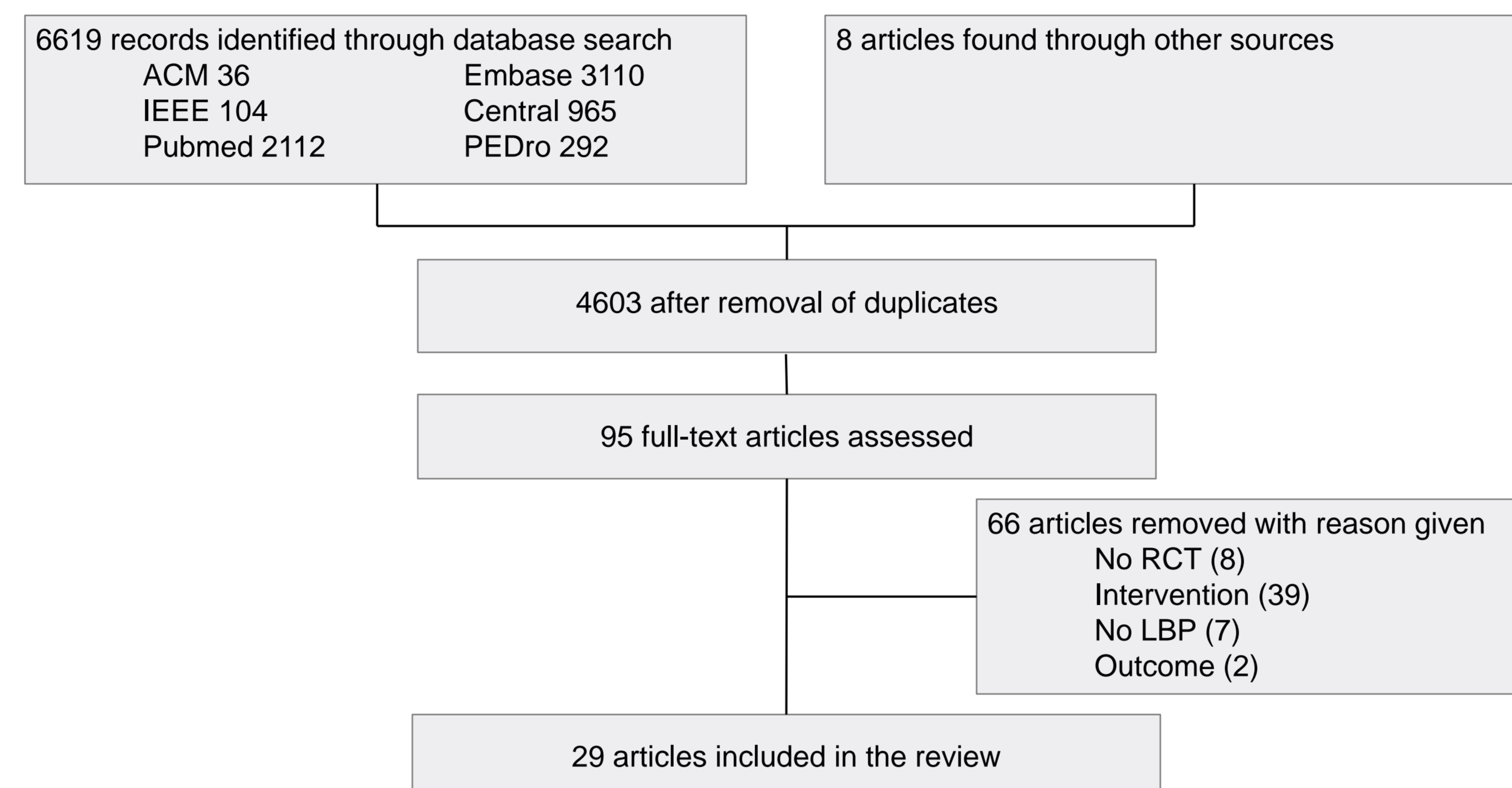
[1] Furlan AD et al. 2009 updated method guidelines for systematic reviews in the Cochrane Back Review. Spine (Phila Pa 1976), 2009 Aug 15;34(18):1929-41



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Results

Flowchart



Overview Technological systems

TSET intervention	comparator
Surface-EMG feedback for increasing or decreasing paravertebral muscle activity (n = 6)	Placebo, Waiting list, Relaxation exercises, Education, Cognitive behavioral therapy, Usual care
Surface-EMG feedback for strengthening or stabilization exercises (n = 3)	Standard physical therapy, exercises without feedback, Waiting list
Fine-wire EMG feedback for Multifidus training (n = 1)	Active extension exercises
Real time ultrasound imaging for Transversus abdominis training (n = 7) or Multifidus training* (n = 1)	Clinical instructions, Pressure biofeedback unit, sit-up training, general strengthening, medical management*
Internet mediated exercise interventions (n = 3)	Exercises without online support, ergonomic advice
Nintendo Wii (n = 2)	Physical therapy + trunk stabilization, Physical therapy
Whole-body vibration (n = 2)	Strengthening exercises, usual care
Postural feedback (n = 1)	Back school
Respiratory feedback (n = 1)	Placebo respiratory feedback
Peripheral magnetic stimulation (n = 1)	Sham stimulation
Video instructions (n = 1)	Exercises without video instructions

Risk of bias

A high level of agreement was reached on the risk of bias assessment resulting in a Kappa value of 0.86 (95% CI: 0.82-0.91). In 55% of the studies a low risk of bias was present.

Effectiveness of TSET

Acute LBP	+ve	0	-ve
Effects on pain			
TSET vs. Other interventions	-	-	1
Standard care + TSET vs. Standard care alone	-	1	-
Effects on disability			
TSET vs. Other interventions		1	
Standard care + TSET vs. Standard care alone	-	1	-
Effects on muscle function			
Standard care + TSET vs. Standard care alone	1	-	-
Subacute low back pain*	+ve	0	-ve
Effects on disability			
Standard care + TSET vs. Standard care alone	2	-	-
Effects on muscle function			
Standard care + TSET vs. Standard care alone	1	-	-
Chronic low back pain	+ve	0	-ve
Effects on pain			
TSET vs. Other interventions	3	5	1
Standard care + TSET vs. Standard care alone	2	1	-
TSET vs. Placebo or waiting list	1	6	-
Effects on disability			
TSET vs. Other interventions	1	5	1
Standard care + TSET vs. Standard care alone	1	-	-
TSET vs. Placebo or waiting list	1	4	-
Effects on muscle function			
TSET vs. Other interventions	6	6	1
Standard care + TSET vs. Standard care alone	1	-	-
TSET vs. Placebo or waiting list	2	3	-

Number of articles are shown: +ve = favours TSET; 0 = no difference; -ve = favours comparison
* Studies from same cohort

Discussion

In most cases, TSET did not yield better results than other interventions. One explanation might be that the TSET-programs mostly adopted a narrow approach to exercise therapy, i.e. training of one particular function of a specific muscle or muscle group. There is growing consensus that exercise therapy for LBP should be tailored to the patient's specific needs, and emphasis is placed on home exercises. Therefore, the implementation of technological systems into functional exercises and into the home environment poses an important challenge. Specific training of M. Transversus abdominis with feedback from RUSI was investigated in six studies. The results are inconclusive as three studies reported improved Transversus abdominis function after training, whereas three papers did not. However, great methodological differences in outcome measures for improved M. Transversus Abdominis function are reported.

Conclusion

- TSET can improve pain and disability in patients with LBP, but in general, TSET did not yield better results than other interventions.
- It remains unclear whether TSET is more effective than other interventions for improving M. Transversus abdominis function.
- Development of future technologies should focus on the applicability in functional movements and in the home environment.