Health and fitness benefits of functional electrical stimulation-evoked leg exercise for spinal cord-injured individuals: a position review

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CRD summary
This review concluded that across a variety of outcome domains functional electrical stimulation-evoked leg exercise promoted certain health and fitness benefits for people with spinal cord injury. Poor reporting of the review process, inclusion of small studies of unknown quality and the possibility of language and publication biases suggests that these conclusions should be treated with caution.

Authors’ objectives
To investigate whether functional electrical stimulation (FES)-evoked leg exercise promoted health and fitness benefits in people with spinal cord injury.

Searching
MEDLINE, MEDLINE Daily Update, PREMEDLINE, OLDMEDLINE, SPORTDiscus, Web of Science (dates spanned 1830 to 31st July 2008) and The Cochrane Library and Cochrane Database of Systematic Reviews were searched. Search terms were reported. FES-specific annual international conference archives with known peer-review criteria were searched for published studies. Any language was included, provided an English abstract that described clear categorical outcomes was available

Study selection
Studies of FES or functional neuromuscular stimulation (FNS) exercise of lower limbs of neurologically disabled people that evaluated health and fitness outcomes were eligible for inclusion. The term exercise referred mainly to predominantly lower limb physical training activities. Movements that may have involved concurrent upper extremity exercise were not excluded. Studies conducted on functional applications of FES (use of FES for daily activities without exercise training for health and fitness only) or technological developments (control approaches, analyses of FES stimulation parameters and controller performance, simulation and modelling studies or research into the technological domain without intention of describing possible physiological benefits) were included if secondary health and fitness were described. Randomised and non-randomised trials and other controlled studies were eligible for inclusion.

Included studies were of a variety of FES interventions. The most common involved FES cycling and some included arm cranking. Duration of included studies appeared to vary from one day to 11 months. Lesion level of patients varied between studies.

It appeared that more than one reviewer performed study selection.

Assessment of study quality
No formal validity assessment was described, but some aspects of study quality were described (whether the study was controlled, randomisation and how patients were allocated to treatment).

The authors did not state how many reviewers assessed study validity.

Data extraction
Outcomes that related to skeletal muscle morphology and biochemistry, cardiovascular and haemodynamic responses, metabolic responses and aerobic fitness changes, bone mineral density and stiffness, functional changes of exercise capacity and psychosocial outlook were extracted.

The authors did not state how many reviewers extracted data.
Methods of synthesis
The studies were pooled in a narrative synthesis grouped by domains of skeletal muscle morphology and biochemistry.

Results of the review
Thirty-two studies (reported in 33 papers) were included in the review (n= 644; range four to 90 patients). One study was a randomised controlled trial (RCT) (n=26) and 31 were randomised or controlled studies (n=618).

Positive changes to skeletal muscle morphology and biochemistry in adherents to FES training were reported in one RCT and five randomised or controlled studies. Seven out of nine randomised or controlled studies reported increased aerobic fitness or positive metabolic responses with FES-induced exercise training. Seven randomised or controlled studies showed positive changes in indicators of functional exercise capacity with FES-induced training. One controlled study reported positive effects of FES-induced exercise on depression levels. Changes to heart rate and blood pressure responses were inconsistent during FES-evoked muscle contractions in six controlled or randomised studies. One out of five controlled or randomised studies reported positive effects of FES on bone mineral density; the other studies were equivocal.

Authors' conclusions
Available data suggested that FES-evoked leg exercise promoted certain health and fitness benefits for people with spinal cord injury across a variety of outcome domains.

CRD commentary
The research question was supported by inclusion criteria for participants, intervention and outcomes; there were none for study design, which may have led to subjective decisions when selecting studies for inclusion. The authors did not report attempts to identify unpublished studies and inclusion was restricted to papers with English abstracts, so publication and language biases could not be ruled out. The review process was not described, so any steps taken to reduce the possibility of reviewer error and bias were unknown. Few aspects of study quality were assessed and so reliability of primary studies was unknown. Participant numbers in included studies were low. Study designs were unclear and few participant details were reported. Narrative synthesis appeared appropriate considering heterogeneity in study designs, interventions and outcomes. Poor reporting of the review process, inclusion of small studies of unknown quality and the possibility of language and publication biases suggests that the authors' conclusions should be treated with caution.

Implications of the review for practice and research
Practice: The authors did not state any implications for practice.

Research: The authors stated that further analyses were needed to determine which type of FES-evoked exercise was best for specific individuals with varying levels and degree of spinal cord injury. The authors made a number of suggestions to improve the quality of trials.

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