FACULTY OF MEDICINE AND HEALTH SCIENCES

PAIN IN MOTION

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EFFICACY OF SPECIFIC SKILLED MOTOR VERSUS GENERAL EXERCISE TRAINING ON PERIPHERAL MUSCLE AND CENTRAL BRAIN ALTERATIONS IN PATIENTS WITH RECURRENT LOW BACK PAIN: PROTOCOL OF A RANDOMIZED CLINICAL TRIAL

The aim of this randomized clinical trail is to examine the short and long-term effects of specific skilled motor control training versus unspecific general extension training on pain, disability, brain structure/function, muscle structure/function, lumbar proprioception and objective pain outcomes in recurrent non-specific low back pain (NSLBP).

Background

Although the cause of persistent NSLBP remains unknown, structural and functional alterations of the brain and paravertebral muscles have been proposed as underlying mechanisms. Specific training of sensorimotor control of the lumbopelvic region (i.e. specific skilled motor training) has shown to decrease pain and disability in NSLBP, but has not been found superior to other forms of exercise training regarding improvements in clinical outcome measures. Furthermore, it is unknown if improvements following exercise training may be attributed to measurable peripheral changes in the muscle and/or central neural adaptations in the brain.

Methods

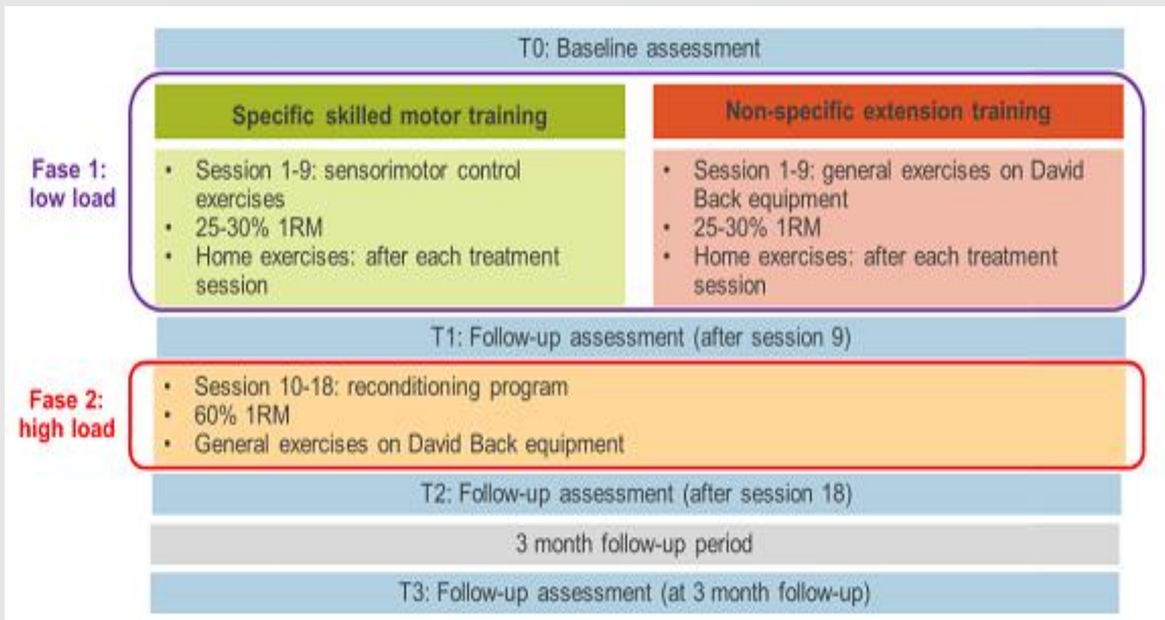
In this double-blind, randomized controlled clinical trial, 62 recurrent NSLBP patients will be randomly allocated (1:1) to receive either specific skilled motor training or general extension training. The primary outcome is LBP-related disability. Secondary measures include: brain structure, structural connectivity, brain function, muscle structure, muscle function, lumbopelvic control, lumbar proprioception and objective pain outcomes. Treatment outcomes will be assessed at baseline, mid-way through the rehabilitation program (i.e. after the 9th treatment session), after finalization of the rehabilitation program (i.e. after the 18th treatment session), and at 3 months follow-up.

Outcomes

Brain	Muscles	Pain	Tests	Questionnaires
Brain structure (i.e. surface area, cortical thickness/volume, cross-sectional area)	Muscle structure (i.e. muscle fat index and cross-sectional area of trunk muscles)	Nociceptive flexion reflex (NFR) threshold, supra threshold and temporal summation	Lumbopelvic control: thoracolumbar dissociation test	Pain: numerical rating scale (NRS), Margolis Pain Diagram
Structural connectivity (i.e. neurite density index, orientation dispersion index, fractional anisotropy, mean diffusivity, axial diffusivity and radial diffusivity)	Muscle function (i.e. metabolic muscle activity, anticipatory and compensatory postural adjustments)	Pressure algometry	Lumbar proprioception: position-reposition test	LBP-related disability: Roland Morris Disability Questionnaire (RMDQ)
Brain function (i.e. resting state functional connectivity)		Conditioned pain modulation (CPM)		Psychosocial factors: HADS, IPAQ-LF, PCI, PCS, PVAQ, SF-36 and TSK.

Interventions

During a 13-week period, participants in each group will receive 18 individual supervised treatment sessions substituted with home exercises. Participants allocated to the skilled motor training group will receive sensorimotor training of the intrinsic muscles of the lumbopelvic region, namely the multifidus, transversus abdominis, and pelvic floor muscles. Participants allocated to the general extension training group will receive general training exercises using the David Back equipment from the Back Unit at Ghent University Hospital. The intervention protocol can be divided in two phases based on the exercise load. In phase one, participants of both intervention groups will receive low load physical training (i.e. exercise intensity ±25-30% of the individual's 1-RM) adjusted to the allocated intervention group (i.e. specific skilled motor training versus general extension training). In the second phase of the intervention protocol, both intervention groups will receive high load training (±40-60% of the individual's 1-RM), administered as general exercises using David Back equipment.



Relevance and implications

The findings of this study will provide novel insights on the short-term and long-term effects of skilled motor training versus general extension training on brain and muscle structure and function in recurrent NSLBP patients. The comparison of specific skilled motor training versus general extension training is of clinical importance as it will aid clinicians in guiding treatment strategies of recurrent NSLBP patients.

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