Umeå University Medical Dissertations, New Series No 1645

Single limb exercises in patients with chronic obstructive pulmonary disease

Feasibility, methodology, effects and evidence

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Akademisk avhandling

som med vederbörligt tillstånd av Rektor vid Umeå universitet för avläggande av medicine doktorsexamen framläggs till offentligt försvar i Aulan, Vårdvetarhuset, fredagen den 23 Maj, kl. 13:00.

Avhandlingen kommer att försvaras på svenska.

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Department of Community Medicine and Rehabilitation, Physiotherapy
Umeå University
Umeå 2014

Organization
Umeå University
Department of Community Medicine
And Rehabilitation, Physiotherapy

Document type
Doctoral thesis

Date of publication
30 April 2014

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Title
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Abstract
Partitioning the exercising muscle mass, known as single limb exercises, is a novel exercise strategy aimed at reducing the negative consequences of chronic airflow limitation in patients with chronic obstructive pulmonary disease (COPD). The aim of this thesis was to study the current evidence of single limb approaches in patients with COPD, to examine the feasibility and effects of a high-repetitive single limb exercise (HRSLE) regimen in patients with COPD and to examine whether elastic resistance bands could be used to evaluate muscular strength.

This thesis is based on five papers. In order to study the evidence on single limb exercises, a systematic review of randomized controlled trials was performed. The review showed that single limb exercises, performed as one-legged cycling appeared to be more effective than two-legged cycling with regard to exercise capacity but not dyspnea, and might be included in exercise programs for patients with COPD (Paper I). Thirty healthy older women and men participated in a validation study comparing elastic resistance maximal strength with isokinetic dynamometry measurements. Excellent levels of agreement and no differences were found between the two pieces of equipment which indicates that elastic resistance could be used to evaluate muscular strength (Paper II). A study protocol was created for a randomized controlled trial designed to identify the effects of HRSLE in combination with COPD-specific patient training (experimental group) in comparison to patient information alone (control group). HRSLE was performed as resistance training, using a single limb at a time, elastic bands as resistance and a high number of repetitions (25 repetitions in 2 sets) with the aim of increasing limb muscle endurance (Paper III). After eight weeks of exercise, the differences between the groups were in favor of the experimental group on lower- and upper-extremity functional capacity, upper-extremity endurance capacity and muscular function. No differences were seen between the groups on endurance cycle capacity or health-related quality of life (Paper IV). In patients with COPD, the HRSLE regimen was considered feasible with a high attendance rate, excellent compliance and high relative exercise intensity. No severe adverse events occurred. Also the physiotherapists conducting the HRSLE in the clinical setting found it to be feasible (Paper V).

This thesis shows that single limb exercises performed as one-legged cycling may be useful and effective for patients with COPD. Eight weeks of HRSLE was feasible and effective with regard to exercise capacity, but without effect with regard to health-related quality of life, in patients with COPD. Elastic resistance bands could be used as exercise equipment to improve limb muscle function in patients with COPD and to evaluate muscular strength in healthy older adults.

Keywords
Chronic obstructive pulmonary disease, elastic resistance, exercise capacity, health-related quality of life, randomized controlled design, single limb exercises, systematic review, study protocol

Language
English

ISBN
978-91-7601-049-5

ISSN
0346-6612

Number of pages
72 + 5 papers