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Short Communication

What Does it Mean to be Physically Active in Chronic Respiratory Diseases?

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Abstract

The increased number of chronic respiratory patients due to tobacco smoking, occupational exposure, environmental and indoor pollution creates an unmet pressure for new medical and financial resources. Pulmonary rehabilitation is a comprehensive intervention demonstrating improvements in symptoms, exercise tolerance and quality of life. Physical and emotional individual benefits along with reduced use of health care services largely failed to change patients' behaviour and to make them more physically active. The classical components of physical training with endurance, strength, inspiratory muscle training and neuromuscular electrical stimulation might be completed by other unknown, forgotten or unconsidered methods, maybe more able to keep patients enthusiastic, motivated and willing to be physically active.

Keywords: *Chronic Respiratory Diseases; COPD; Pulmonary Rehabilitation; Physical Activity*

Introduction

Due to low level of exercise capacity, people with chronic respiratory diseases gradually become physically inactive by adopting a sedentary lifestyle. They spend less time walking and standing and more time sitting and lying; their outdoor activity is poor or inexistent [1]. It is known that physical inactivity, skeletal muscle dysfunction and deconditioning in chronic obstructive pulmonary disease (COPD) is associated with poor outcomes, including increased mortality risk [1,3]. Pulmonary rehabilitation (PR) has emerged from the need to encourage chronic patients to become physically active and has become an essential component of comprehensive integrated care. It has been proved to be one of the most safe and effective interventions for people with COPD and other chronic respiratory diseases [4], designed to reduce symptoms, optimise functional status and increase participation in activities of daily living [2]. PR involves an initial assessment, exercise training, education and behaviour change. Exercise training, the cornerstone component of PR, aims to improve aerobic capacity, muscle strength and/or flexibility; to be effective, physical training must address the patients' needs, exceed loads met during daily life and have a progressive application pattern [1,5].

Physical activity is defined as any bodily movement produced by skeletal muscles that results in energy expenditure. It comprises leisure-time, domestic and occupational activities, activities of daily living (everyday tasks required for personal self-care and independent living) and exercise. Physical inactivity, simply defined as the absence of physical activity, is a fundamental characteristic of many chronic diseases, being a cause and a consequence as well [6]. Reactivation of the patients by promoting a physically active lifestyle during and after PR courses has become a solid problem that needs to be recognised and addressed [3].

The recommended physical activity programmes in pulmonary rehabilitation guidelines

Pulmonary rehabilitation has significant benefits in improving symptoms, exercise tolerance and quality of life [1]. The main body of evidences comes from COPD patients, but it has been used with positive outcomes in other chronic respiratory diseases as interstitial lung disease, bronchiectasis, cystic fibrosis, asthma, pulmonary hypertension, lung volume reduction surgery and lung transplantation [1,7], and its applicability should be strengthened. Various modes of training are recommended within conventional pulmonary rehabilitation programmes: endurance training, resistance training, inspiratory muscle training and neuromuscular electrical stimulation [1,6].

Endurance training performed by cycling and walking is the most applied exercise modality in pulmonary rehabilitation. It conditions the muscle of ambulation and improves cardiorespiratory fitness to allow an increase in physical activity with reduced dyspnoea and fatigue. Constant high intensity endurance exercise training might be difficult for more severe and breathless patients; they might benefit from low intensity endurance training, interval training, treadmill or ground walking, Nordic walking and calisthenics [1,6,8].

In resistance (strength) training, local muscles are trained by repetitive lifting of increasing heavy loads. Lower limb muscles, especially quadriceps, are trained by stair-climbing and sit-to-stand exercise, while upper limbs benefit from supported (cycle ergometer) and unsupported exercises (elastic bands, free weights, pulleys, throwing balls) [1,9]. When added to endurance training, resistance exercises offer additional benefits in muscle force and mass, and ability to perform specific tasks, but it has no contribution to overall exercise capacity or health status [1].

In individuals with COPD have been shown significant improvements in inspiratory muscle strength and endurance with inspiratory muscle training. Therefore, meaningful reductions in dyspnoea during daily life activities, improvement in walk distance and health-related quality of life have been noticed; but all these gains will disappear 12 months after training cessation [1]. It is debatable if inspiratory muscle training should be a compulsory activity apart from the whole-body exercise training, but it seems to be useful in those patients unable to walk or cycle due to different comorbidities, or with marked inspiratory muscle weakness [1].

Transcutaneous neuromuscular electrical nerve stimulation (NMES) of skeletal muscle over traditional acupuncture points is reserved to severe dyspnoeic patients, with a poor baseline exercise tolerance or with prolonged respiratory failure [1,8]. Repeatedly contraction of quadriceps leads to improved lower muscle strength, exercise capacity and reduces dyspnoea, but this is a passive physical activity elicited by small, inexpensive, portable electrical stimulators, suitable even for home use. People benefiting from NMES are too disabled to leave home, require home mechanical ventilation or lack access to standard pulmonary rehabilitation programmes [1]; it should be also considered in early rehabilitation of COPD patients admitted to the hospital [2].

To promote a sustained increase in physical activity, PR requires structural behaviour changes to the patient. That would allow the patient to perform 30 min of physical activity of moderate intensity in addition to normal daily activities at least 5 days per week. If not being able to generate long-term adherence to health-enhancing behaviour through maintenance strategies, the benefits of PR appear to last no more than 12 months, with quality of life better maintained than exercise capacity [1,10]. There are different methods to continue exercises and physical activity supervised or unsupervised at home and/or in community settings through group activities with other people having similar needs and experiences [1,3].

Despite being demonstrated the physiological, symptom-reducing, psychological and health economic benefits of PR for patients with chronic respiratory diseases, PR is grossly underutilized worldwide [5]; there is a relatively poor uptake of PR in general, but particularly for non-COPD patients [3]. Moreover, they have been used non-individualised PR programmes, instead of considering each patient's clinical, functional, environmental and social features throughout individually tailored, personalised programmes [3,11]. Up to half of eligible patients referred to PR never attend, and only 49% have an acceptable attendance rate (70% of sessions) [12] and its effect disappear in

12 months, so alternative methods for components of exercise training should be proposed. Adoption of alternative models for PR will require comparable or greater clinical outcomes than conventional PR programmes, and the evaluation of safety, cost-effectiveness, staff training and guideline development [5].

Are there some other options?

The need to have a correct breathing in chronic respiratory diseases is obvious. People with COPD generally have dynamic hyperinflation which limits the exercise capacity [1], thus changing the irregular breathing to a correct one is a must; breathing training and abdominal breathing usefulness are generally underestimated. Yoga breathing (sequential mobilization of diaphragm, lower chest and upper chest when breathing in, while adopting a slower and deeper pattern with prolonged expiration) [13], pursed-lips breathing (for an improved breathing out of the air) and computer-aided breathing feedback [1] are some possibilities easy to be implemented.

A correct breathing is promoted throughout the Buteyko Breathing Technique (BBT). There is a set of breathing exercises developed by the Russian physician and scientist Konstantin Pavlovich Buteyko in the 1950s, aiming to maintain the correct ratio of oxygen and carbon dioxide within the bloodstream. The exercises promote nose-breathing and taking an effective amount of air. The BBT or breathing re-training is highly beneficial for asthma sufferers in terms of reducing symptoms (cough, breathlessness, wheezing), improving sleep, ability to exercise, quality of life, and even a reduced need of medication [14]. Moreover, it is also helpful for the patients with other chronic respiratory diseases like chronic bronchitis, emphysema, COPD, bronchiectasis, snoring, sleep apnoea, sinusitis, rhinitis and allergies [14]. To prevent and even to treat an asthma attack, the patient should sit with the back upright, stop breathing for 5 seconds by holding both nostrils with the thumb and index, then release the nose, breath shallow through the nose for 20 - 30 seconds and have another 5 seconds break. This pattern of breathing should last for 5 minutes.

Water-based exercise training appeared to be more effective in improving exercise capacity than land-based exercises or no training in a study conducted by McNamara., *et al* [15]. Fatigue and dyspnoea were reduced in people with COPD and physical comorbidities (musculoskeletal, neurological and obesity), with important outcomes for daily life. Some properties of water are responsible for these findings, like unique capacity of water to support body weight (thus reducing impact of comorbidities on exercise), resistance and turbulence with increased exercise intensity and effects of warm water over muscle blood flow [15].

Tele-rehabilitation and home-based PR may be best suited to people with limited access or unable to get to hospital-based outpatient programmes, ideally to promote physical training in their safe and friendly environment [4]. They can continue with exercises taught at the hospital, or may replace them with sit-to-stand from a dining chair, step ups on an internal or external stair, walking outdoor, using resistance elastic tubes, or water bottles for upper limb weights [5,12]; they might be supported by PR programme staff, with or without specialised exercise equipment [5,7].

Energy medicine is one of the major categories of complementary and alternative medicine. T'ai chi is a traditional Chinese medicine form involving the whole body, characterised by circular unique movements, described as slow, smooth flowing and graceful; it is thought to strengthen the body's vital energy and enhance the passage of energy throughout the body [2,16,17]. It incorporates elements of muscle endurance and strengthening, balance, relaxation and breathing. Sun-style t'ai chi comprises less difficult movements, less deep-knee bending and single-leg standing, being more suitable for older people [17]. In a randomised trial conducted by Leung., *et al*. 12 weeks of Sun-style t'ai chi improved exercise capacity, balance, physical performance, quadriceps strength, health-related quality of life, anxiety and self-reported difficulty in functional performance in 42 patients with COPD, as compared to a usual control care group [16,17].

In Reiki, an ancient therapy originated in Tibetan sutras, there is a special breathing exercise leading to an increased respiratory capacity. It can be performed while sitting or better while walking. In the first week, a long breathing out (six seconds or six steps) will be followed by a long breathing in of an equal number of seconds or steps; the session will be stopped at fatigue. Second week will bring

an increase from six to seven seconds or steps for breathing out and breathing in respectively. In the third week, it will be a progressive increase from 6 seconds or steps for breathing out and breathing in to thirteen seconds or steps and backwards. This breathing exercise will be respected for the rest of the patient's life and will be performed in his own rhythm.

Conclusions

Physical activity is not largely embraced by chronic respiratory patients. It is a symptom-evoking strategy, time and energy user, requiring daily motivation and determination to be pursued. Despite being an insufficient provision for all patients worldwide, the rates of not presenting or early dropping are unacceptable high. Even if offered in most countries for free and having multiple proved benefits, patients feel exhausted by all procedures of testing and exercising and do not attend PR courses as expected. Maybe it has come time to think other methods to keep people motivated, happy and physically active, like singing, dancing, creatively playing and trip-making. They might be incorporated in conventional PR programmes and create an enthusiastic long-term adherence, the final purpose of any rehabilitation course.

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