

Functionality of patients with chronic obstructive pulmonary disease: energy conservation techniques*

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ABSTRACT

Chronic obstructive pulmonary disease is a progressive and debilitating disease that is typically diagnosed only after a long period of gradual worsening. Dyspnea is the symptom that most often interferes with the execution of professional, family, social and daily-life activities of patients with chronic obstructive pulmonary disease. Such limitations can lead to a sedentary lifestyle and worsen overall quality of life. This article aims to address the functional limitations these patients deal with in carrying out their daily-life activities, establishing guidelines that health professionals can use to help their patients achieve maximum functionality. Guidelines for the use of energy conservation techniques are widely used in pulmonary rehabilitation programs. However, these guidelines should also be used in outpatient clinics and hospitals. A great number of human activities involve the legs and arms. The arms are involved in virtually all everyday activities - from the most simple to the most complex. Some studies have shown that upper-body exercises in which the arms are not supported cause thoracoabdominal asynchrony and dyspnea in shorter times and with less oxygen consumption than in exercises involving the legs. Even simple tasks can result in high oxygen consumption and minute ventilation, which accounts for the sensation of dyspnea reported by the patients. In view of these facts, it is appropriate to evaluate the impact that such incapacity has on daily life in patients with chronic obstructive pulmonary disease. Techniques of energy conservation that can be used as tools to minimize the discomfort of such patients are herein discussed, and those considered most appropriate are highlighted.

Keywords: Pulmonary disease, chronic obstructive/rehabilitation ; Activities of daily living; Energy metabolism; Task performance and analysis

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INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is a progressive, debilitating disease that, unfortunately, is only diagnosed after a long period of gradual worsening of symptoms. However, it can be prevented and treated.⁽¹⁻²⁾ The symptoms of COPD, especially dyspnea, frequently interfere with various aspects of the life of the patient, such as professional, family, and social activities, as well as activities of daily living (ADLs), leading to depression and anxiety, as well as to a significant reduction in quality of life.⁽³⁻⁴⁾

Energy conservation techniques are tools that have been used in pulmonary rehabilitation programs with the aim of helping improve the scenario described above. The idea is to reduce the energy expenditure of the patients with COPD during the performance of their ADLs, decreasing the sensation of dyspnea and increasing the functionality of these patients.

ACTIVITIES OF DAILY LIVING

The ADLs are defined as tasks of occupational performance that a person carries out every day, to prepare for or as adjuncts to the tasks of their role in life. ADLs are activities related to personal care and include dressing oneself, eating, bathing, hair combing, answering the phone, communicating through writing, handling correspondence, managing money and organizing books/newspapers are all considered ADLs, as are activities related to physical mobility/capacity (turning over in bed, sitting, moving about and going from one place to another).⁽⁵⁾

The ADLs can be subdivided into basic ADLs, which are those automatically done every day by virtually every human being (maintaining personal hygiene, bathing, dressing, putting on shoes and walking around) and instrumental ADLs, which are those more complex activities that demand more functional independence (cooking, putting away utensils into cabinets, tidying up the kitchen and washing clothes).⁽⁶⁾

Although there are differences regarding the definitions of ADLs, it is important to bear in mind that patients with COPD have more or less difficulty in performing them, depending on the pulmonary and physical involvement they present. However,

in clinical practice, it is common for patients to report greater difficulty in performing activities that involve the upper limbs in relation to the lower limbs, especially when those are used without support.

REPERCUSSION OF ADLS IN PATIENTS WITH COPD

Patients with COPD usually report a disproportionate degree of fatigue when performing ADLs. In activities such as 'tying shoes' and 'combing hair', it has been demonstrated that COPD patients develop an pattern of rapid, irregular shallow breathing during their performance, afterwards breathing rapidly and deeply. This postexercise pattern occurs due to the rapid and ineffective shallow breathing during the bending and arm muscle exertion involved in the activities evaluated, resulting in postexercise compensatory **hyperventilation**.⁽⁷⁾

Unsupported upper-limb exertion leads to thoraco-abdominal asynchrony and dyspnea in less time and with less oxygen consumption than do exercises involving the lower limbs.⁽⁸⁾ In these cases, the thoraco-abdominal asynchrony that occurs is not due to diaphragmatic fatigue.

The most common functional ADLs involve the upper and lower limbs. However, the upper limbs are extensively used to perform all types of activities, from the simplest to the most complex. Some of the muscles that participate in the positioning of the arms, such as the trapezoid, minor pectoral, scalene and intercostal muscles, can have postural and ventilatory functions.⁽⁹⁾

Simply lifting the arms results in considerable increase of oxygen consumption (16%) and pulmonary ventilation (24%) in normal individuals, in addition to increasing the final inspiratory gastric and transdiaphragmatic pressure. These data suggest that lifting the arms affects ventilatory and postural muscle recruitment, thereby altering the mechanics of the chest cavity and abdominal cavity. It is believed that some of the upper trunk muscles, when involved in the positioning of the arms, cease to participate in ventilation, transferring the ventilatory work to the diaphragm. In addition, lifting the arms results in changes in the impedance of the trunk, rib cage and abdominal wall, increasing the load put on the diaphragm to respond to the ventilatory demand.⁽¹⁰⁾

These findings were confirmed by some authors,⁽¹¹⁾ who observed that the tasks performed by the unsupported upper limbs result in significant increases in metabolism and ventilation, and that patients with COPD respond to this demand by adopting a pattern of rapid, shallow breathing. The authors showed that, in such cases, changes occur in the pattern of respiratory muscle recruitment. During simple ADLs involving the upper limbs, such as eating, brushing teeth, combing hair, bathing and dressing, these changes were found to be related to the perception of dyspnea and to fatigue. The authors concluded that a four-week program of upper-limb training leads to improvement in the performance of the ADLs.

Generally speaking, there is no significant difference between clinically stable patients with COPD and normal individuals of the same age in terms of the energy expenditure at rest, although COPD patients present greater relative energy expenditure per activity.⁽¹²⁾

The performance of relatively simple tasks, such as sweeping, erasing a blackboard/whiteboard, lifting pots and changing light bulbs, results in oxygen consumption that is approximately 50% to 60% of the maximal oxygen uptake and increases the minute ventilation, with the use of approximately 60% to 70% of the maximal voluntary ventilation, which explains the sensation of dyspnea and physical discomfort experienced by patients with COPD.⁽¹³⁾

Patients with COPD consume a significant portion of their available energy to perform simple ADLs. The sensation of dyspnea is significantly more intense in patients with COPD than in normal individuals, principally during activities that demand greater effort, such as walking, walking while carrying weight and climbing at least two flights of stairs.⁽¹⁴⁾

Patients with moderate to severe COPD, as well as sedentary patients, while performing ADLs that involve the upper and lower limbs (walking on a treadmill, lifting pots, walking while carrying a 5 kg weight, making movements like the ones in showering, putting on shoes, climbing stairs), present dynamic hyperinflation. This dynamic hyperinflation can be easily determined by measuring the inspiratory capacity.⁽¹⁵⁻¹⁶⁾

Patients with COPD, when submitted to training of the upper and lower limbs in pulmonary

rehabilitation programs, report improvement in the sensation of dyspnea while performing their ADLs. The exact reason for these changes has yet to be clarified. Various mechanisms, such as desensitization to dyspnea, improvement in physical condition, better coordination of the muscles involved in raising the arms and metabolic muscle adaptations, are involved.⁽¹⁷⁾

EVALUATION OF ADLs AND THE USE OF ENERGY CONSERVATION TECHNIQUES

Taking into consideration the fact that 78% of the patients with COPD have dyspnea when performing everyday activities, and that approximately 55% of them require assistance to perform them,⁽¹⁸⁾ it is highly appropriate to evaluate, in detail, the impact that COPD has on the daily life of these patients.⁽¹⁸⁾

Evaluating the ADLs is not a simple task, and it is even more difficult when the patient is brought to a laboratory and is asked to perform a certain activity in front of the examiner. The evaluation of the occupational performance of a patient, in order to determine the deficiencies that should be treated or to which the patient must learn to adapt, consists of systematic observation, interviews or both. When ADLs are the focus, the ideal is to observe them at the time of day at which and place in which they are performed.⁽⁵⁾

Patients submitted to an evaluation should be classified as to their functionality, based on the degree of dyspnea they present, and can be distributed as follows: Class I - minimal restriction in the performance of ADLs and instrumental ADLs related to work, leisure and social activities (occurrence of dyspnea only during the performance of those requiring greater physical exertion); Class II - independent in virtually all activities (presenting dyspnea when climbing stairs or when the activity involves bending); Class III - similar to Class II, but with altered walking capacity (cannot keep up with people of the same age, setting their own pace); Class IV - dependent in some ADLs (dyspnea upon exertion, requiring rest breaks during activities such as dressing, walking and climbing stairs - generally housebound, leaving home only when accompanied); Class V - confined to bed or wheelchair (requiring assistance in all activities).⁽¹⁹⁾

A frequently employed means of evaluating the

performance of patients in their ADLs is to ask them to mime their activities, performing them as if they were at home, without interference by the examiner. During the performance of the activities, the examiner can have an idea of how long it takes the patient to perform each activity and of what body position is adopted, as well as of the changes in dyspnea, heart rate and oxygen saturation by pulse oximetry. The data collected in this evaluation are important for the development of an orientation program designed to modify the habits of the patients, including the use of energy conservation techniques.

The Guidelines for Pulmonary Rehabilitation Programs of the American Association of Cardiovascular and Pulmonary Rehabilitation, published in 1993,⁽²⁰⁾ was one of the first international documents that indicated the need to teach energy conservation techniques during pulmonary rehabilitation programs. These techniques have the objective of decreasing the energy expenditure of the patients during the performance of their ADLs, consequently decreasing their sensation of dyspnea, increasing their functional performance and improving their quality of life.

It is currently recommended that energy conservation techniques be used in all pulmonary rehabilitation programs in order to decrease the sensation of dyspnea, as well as to prevent, reduce or delay dysfunction during the performance of ADLs, thereby increasing the functional capacity of the patients. It is also necessary to disseminate these techniques to the professionals who treat these patients in outpatient clinics and hospitals, so that they can provide guidance on the most efficient way to perform ADLs, with less energy expenditure, in order to avoid discomfort and dyspnea.

The use of energy conservation techniques, the adaptation of the environment, and the appropriate posture for the performance of the ADLs have proven efficient in reducing the sensation of dyspnea, oxygen consumption, production of carbon dioxide and heart rate of patients with COPD. These findings confirm patient reports of improvement in their performance of ADLs.⁽²¹⁾ Our clinical experience, however, shows that these patients have great difficulty in changing their lifestyle and adapting to the routine use of these techniques in their daily life.

According to some authors,⁽²²⁾ the objectives of

energy conservation and training of ADLs are the following: training diaphragmatic breathing, first at rest so that the patient acquires the perception of the respiratory movements during inspiration and expiration and, later on, during the performance of the tasks, avoiding the brief periods of apnea than can occur; training the upper limbs, with the objective of increasing exercise tolerance; programming activities with distinct levels of demand, beginning with light, slow activities that require less energy expenditure, such as personal hygiene activities performed while sitting, with upper limb support (brushing teeth, combing hair, shaving, face washing, applying makeup), followed by those performed while sitting without upper limb support (shaving armpits and showering); simplifying the performance of some tasks by adapting the environment (elevating the toilet seat and installing support bars/hand rails in the bathroom) or by using assistive technology (long-handled shoe horns, long-handled combs, walkers with seats and bags, etc.); eliminating unnecessary activities, such as dish drying (using a drain rack instead), drying after bathing (using a plush robe) and shoe tying (wearing slip-on shoes); informing patients of the importance of asking for help from family members, caregivers or others, when necessary; organizing time, planning the day/week, calculating the time spent in the performance of activities/the time needed for rest and encouraging the use of organizers; organizing the environment so that the materials that are going to be used by the patient are within reach, that is, between the scapular and pelvic girdles, reducing the need for broad movements of the upper limbs without support, as well as avoiding bending; educating the patient regarding the most appropriate postures for the performance of each task, adapting the way in which the activities are performed (using a table, counter, or even the bathroom basin, to support the arms, as well as eliminating the need to bend over.

The nine objectives mentioned above can be achieved in a simple way and at a low cost. An educational program, combining the theory and the practice of the energy conservation techniques, produces very satisfactory results regarding their use by the patients, although it implies a change of habits in the performance of the ADLs, which is difficult to achieve, principally among elderly individuals.

For patients with COPD, the adaptation of the environment and the postural change in the performance of the ADLs are often achieved in a simple manner. An example of that can be seen when the bathroom mirror is lowered, thereby preventing the patient from performing personal hygiene in the orthostatic position and with upper limbs without support (Figure 1). Teaching patients to cross their legs while putting on and taking off shoes eliminates the need to bend over during this ADL (Figure 2). Organizing the environment and

the frequently used objects, avoiding the broad movements required to put away utensils in places that are too high (Figure 3) or too low (Figure 4).

Other solutions can be found for everyday situations, such as showering. For example, the use of a waterproof stool or chair in the shower can make showering much easier for patients with COPD.

Energy conservation techniques help the patient maintain their functionality in an active and independent way, breaking the cycle of inactivity (Figure 5), even if the patient has to



Figure 1 - A) Patient performing personal hygiene activities without using energy conservation techniques; B) Patient performing personal hygiene activities using energy conservation techniques



Figure 3 - A) Patient putting away utensils on high shelves without using energy conservation techniques; B) Patient putting away utensils on high shelves using energy conservation techniques

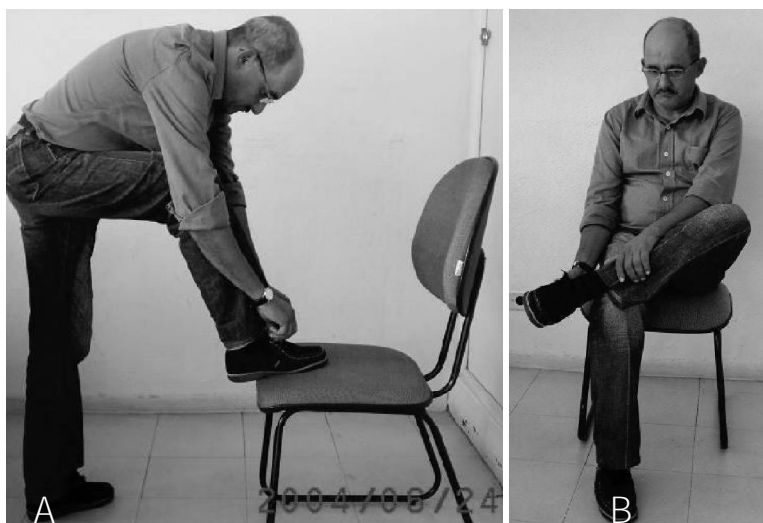


Figure 2 - A) Patient putting on shoes without using energy conservation techniques; B) Patient putting on shoes using energy conservation techniques



Figure 4 - A) Patient putting away utensils on low shelves without using energy conservation techniques; B) Patient putting away utensils on low shelves using energy conservation techniques

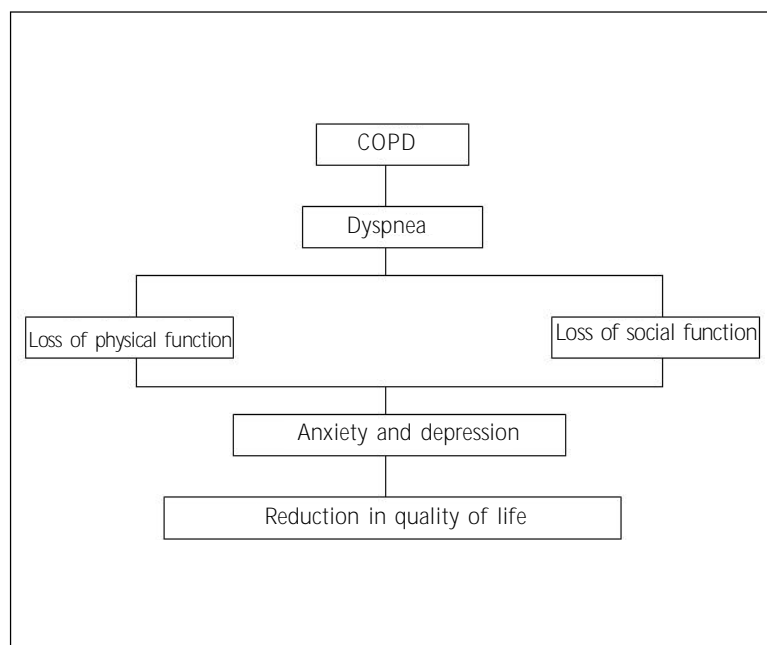


Figure 5 - Flowchart representing the cycle of loss of physical function of the patient with COPD

COPD: chronic obstructive pulmonary disease

perform these activities at a slower rhythm. Using these techniques can decrease the dyspnea and discomfort that typically lead patients with COPD to reduce or even abandon their functional activities.

In summary, in order to intervene in an efficient manner in the function of patients with COPD, it is necessary to implement an educational program (for patients and families) in which the various aspects of COPD are analyzed, including the use of energy conservation techniques, as well as a program of upper- and lower-limb training.

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