

# Physiotherapy for respiratory diseases

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## Abstract

The respiratory system is crucial to human life. Its performance determines the quality of life. Physical training helps patients suffering from various diseases of this system to build up physical fitness, improve breathing mechanics and reduce clumsy secretion in the bronchial tree. The right choice of techniques for working with such a patient is important. They use fitness training, strength training, breathing exercises, bronchial tree cleansing. Always consider possible contraindications

Keywords: breathing exercises, pulmonological rehabilitation, physiotherapy for respiratory diseases, bronchial tree drainage.

## Introduction

The respiratory system is one of the most common causes of diseases today. It is predicted that respiratory diseases (after cardiovascular diseases and, in some countries, after HIV/AIDS) will be the cause of death for a large proportion of the population in the future [1]. Respiratory diseases that occur frequently in the population include lung cancer, COPD, asthma, bronchial tension, cystic fibrosis, pneumonia and others. The development of diseases

generates the development of new methods of therapeutic action. The overarching goal is to develop a form of therapy that improves the functioning of the patient.

The characteristics of the symptoms and the different course of chronic respiratory diseases significantly influence the quality of life of patients [2].

Respiratory physiotherapy should be an integral part of any physiotherapy program. The respiratory program is crucial for patients:

- Diseases with secretion residues in the respiratory tract such as: cystic fibrosis, bronchi, chronic obstructive pulmonary disease (COPD), bronchial asthma, people who are hypokinetic regardless of the cause (e. g. after bone fractures, as a result of illness, unconscious)
- Diseases with insufficient ventilation of the lungs (due to insufficient air supply into the air vesicles or restricted physiological expansion of the lungs) such as respiratory disorders in COPD and bronchial asthma, respiratory disease (in hypokinetic or pleural-related pneumothorax or inflammatory asthma), malformations and limitations of chest mobility (chicken breast, scoliotic), severe obesity
- with reduced breathing capacity, low strain tolerance due to insufficient ventilation of the lungs and shortness of breath;
- with neuromuscular diseases affecting lung function, such as Parkinson's disease, MS;
- with rheumatoid disorders affecting the mobility of the spine and chest, e. g. ZZSK [3]
- with malposition of the spine causing improper mobility of the chest and malformations, e. g. scoliosis [4]
- before surgery and after surgery in the chest or abdomen;
- Patients relying on a ventilator [5].

Respiratory diseases are always associated with impairment of physical performance. This is reduced even further, as respiratory diseases can be a contraindication to physical activity. Inactivity and a thrifty lifestyle also affect the occurrence of back pain in addition to the underlying disease. In order for the body to remain balanced, so that the organs can work together in spite of illness, the weakened structures must be strengthened. In particular, the increase of respiratory and general physical performance. Therefore, respiratory

physiotherapy not only teaches the correct breathing, but also the activation of those elements that are classified as reserves in a state of health.

The main goals of respiratory physiotherapy are:

- increasing ventilation of the lungs by improving the airways and increasing the amount of air that is effectively involved in the exchange of gas in the air bubbles (e. g. removing secretions from the bronchi or expanding the bronchi and using an appropriate breathing method that increases the volume of inhaled and exhaled air);
- to facilitate the treatment of respiratory problems due to loss of air or insufficient ventilation in certain areas of the lungs (e. g. pneumothorax, pneumonia, thoracic deformities);
- Avoidance of complications related to insufficient ventilation of the lungs (hypothia, pneumonia);
- Reduce respiratory work and increase respiratory performance with physical exertion;
- Relief of symptoms of lung disease (dyspnoea, rapid fatigue, cough) and improvement of breathing comfort.

## Exercises and training for respiratory diseases

Studies have shown that respiratory rehabilitation can have the following effects on people with lung diseases: reduced rest and exercise breathing, increased physical performance, improved quality of life, improved mental function, re-entry to work, ability to perform everyday activities (e. g. business visit, house cleaning), increased social inclusion improved disease awareness [6] (especially older people) have relatively little knowledge of the importance of physical activity in the prevention of various diseases [7] . Physical improvement of respiratory disease should include components such as endurance, interval, strength, respiratory muscle, chest and shoulder girdle mobility and, as required, a bronchial tree toilet and others.

Endurance training – usually 3-5 times a week, involves continuous exercise for 20-60 minutes in one training session. Examples are hiking, cycling, hiking, Nordic walking. This type of training is the basis of the respiratory rehabilitation program for respiratory diseases. It is usually carried out on a treadmill or a cycle ergometer using a continuous and interval-based method. According to the guidelines of the American Thoracic Society and the European Respiratory Society, continuous training includes a 30-minute activity with an

intensity of at least 60% of the maximum oxygen intake. This type of training improves physical performance and reduces the feeling of shortness of breath. The imperfection of continuous training is that it is often difficult for patients to keep to the recommended time and intensity. The alternative is the interval form [8]. Meta-analyses show that endurance training leads to an increase in peak work rate of about 18%, an increase in peak oxygen uptake by 11% and an increase in physical endurance by 87% [9].

Interval training – is a type of endurance training, consisting of high-intensity activities and regular breaks, which include exercises with low intensity or rest. In the training, short-term exercises with high intensity of almost 100% of the peak VO<sub>2</sub> are performed, divided by 30 seconds breaks or exercises with low stress [8]. An example of such training would be cycling at high intensity for 30 seconds, then pausing or riding a bicycle at lower intensity for another 30 seconds and then returning to high intensity several times, etc. This can also be going according to such a scheme, running, training on a treadmill, elliptical cross trainer, etc.

Strength training involves overcoming external resistance by working your own muscles to improve muscle strength. It is particularly beneficial for training the muscles that are used in everyday activities. Examples of this are exercises with the resistance of a rubber band, a spring, a rubber ball, a dumbbell, etc.

Respiratory Muscle Training – This is performing exercises to strengthen the respiratory muscles to increase muscle strength and ability to perform exercises. Breathing exercises are associated with a dual respiratory control mechanism. It is a conscious control of muscle work or automatic breathing without the patient's consciousness[10]. Breathing exercises are a repeated cycle of inhalation and exhalation. They are carried out according to the so-called breathing pattern in certain body positions. The respiratory pattern consists of the frequency and extent of the breaths, the ratio of inhalation to exhalation, the airway, the chest symmetry, the auxiliary muscle, the nasal and oral respiration and the additional breathing behavior [11]. When breathing, it is important to maintain an upright body shape (if this is possible due to the patient's condition) by pulling down the natural curvatures of the spine and the shoulder blades close to the spine. Breathing exercises cause contractions of the muscles directly involved in breathing (diaphragm, external intercostal muscles and abdominal muscles). Depending on the type of exercises performed, they may be classified as active (performed by the patient), passive (performed with the help of a physiotherapist, nurse or instructor), passive (without patient involvement). Breathing training consists of breathing resistance

exercises with special instruments (e. g. exhaling through a tube into a bottle with up to 2/3 water), threshold exposure for inhalation and isocapnic hyperventilation [12] . It is recommended that resistance exercises be performed at an intensity of approximately 30 to 35% of the maximum inhalation exercise on 4 to 5 days per week [13]. Examples of this are resistant exhalation (e. g. through a straw/tube for a drinking bottle) or inhalation (e. g. with a respirator, a sand-filled pouch on the chest or diaphragm, with a band around the chest and the inhalation resistance )

As part of the breathing exercises, breathing techniques are used to reduce the feeling of shortness of breath, namely: controlled breathing and breathing by “taped mouth. ” Breathing control technique is best performed while sitting. If the patient’s condition does not allow for a position, you can work in a semi-lying position. During the exercise, the patient needs to relax the supporting breathing muscles (especially shoulder and neck muscles). Then it begins to breathe in through the nose (which warms and moisturizes the air) and then slow, prolonged, relaxed exhalation with activation of the corresponding airways (lower chest and abdominal breathing). The breath should be calm, shallow, free. Breathing with laced lips is a technique that can be added to normal breathing in peace and movement. It consists of the lips being slightly compressed when exhaling. Examples of exercises for breathing out through laced lips are:

- Inhale-exhale with the pronunciation of “sssssss”
- Inhale – Exhale with the pronunciation of “ffffff”
- Inhale – exhale with the pronunciation of “ppppppp”
- Inhale-exhale with mouth position as for whistling or blowing a candle
- Inhale-exhale as if blowing into the nostrils (the lower lip is placed on the upper lip)

Breast movement training – this makes breathing mechanics easier for the patient. Over time, joint mobility generally decreases, especially rotation. Examples of this are exercises for flexion, stretching, rotation to the right and left of the spine.

Diaphragm exercises are important for the efficiency of breathing mechanics. It is worth noting that diaphragm exercises do not lead to breathing in such a way as to accentuate the abdominal wall, but rather to enlarge the bottom of the chest while keeping the abdomen flat.

For relief, the patient may place his hands on the lower corners of the ribs and then direct the inhaled air towards the palm of the hand.

## The Bronchial Tree Cleaning

The Bronchial Tree Cleaning – aims to remove the secretion of the respiratory tract that contributes to recurrent inflammation and respiratory distress [12] . It is based on the recording of drainage positions that facilitate the removal of dense secretions associated with the effect of gravity [14]. Pharmacological measures to dilute the dense secretion of the respiratory tract and to facilitate coughing must be administered prior to drainage (mucolytic medicinal products). It is a good solution to inhale with such drugs or at least to inhale with saline solution.

One element of the toilet is the drainage. The patient is positioned in such a way that the purified airway is above the lung cavity (e. g. in the middle of the sternum), allowing the secretion to flow unhindered by gravity. Depending on the location of installation, different drainage positions are used. The discharge of secretion can be achieved e. g. in the Trendelenburg position, where the patient lies with his back and the head, upper chest and trunk are below the lower extremities. Drainage is best done on special drainage beds with the possibility of adjusting the patient's position. Simple deckchairs can be used in which the back legs of a lounger are placed with washers of 20-30 cm or a fixed roller for the patient's hip, so that the head is 10-20° lower. Treatment is performed several times during the day, depending on the amount of secretion retained and the patient's condition. During the stable period with dilatations and cystic fibrosis, it is recommended to perform the operation 2 times a day. During the infection period, the number of treatments should be increased. The duration of a static drainage session is about 30-60 minutes. If appropriate, 2-3 sessions per day should be held, for sessions longer than 30 minutes, for 30-minute sessions 4-5 times per day. Drainage should be done in patients with an unfilled stomach, i. e. before a meal, but at least two hours after a meal. The patient should wear loose clothing that cannot move. Contraindications for drainage are: fresh ischemic or haemorrhagic stroke, condition after neurosurgical operations on the skull, aortic aneurysm, unstable coronary heart disease, fresh heart attack, condition after oesophageal fusion or gastroesophageal reflux surgery, severe arrhythmia, advanced insufficiency Respiratory or gastric haemorrhage, history of epilepsy and unstable hypertension [15], pulmonary oedema, ascites, Strict immobilisation after

orthopaedic surgery, pregnancy, bleeding from the respiratory tract or digestive tract, intolerance to reversal positions.

The second cleansing of the bronchial tree, which is helpful in removing bronchial secretion, is knocking. Helps detach the walls of the bronchi. They are executed in several series of a few minutes. To knock, the hand of the knocker must be placed correctly, with a “bowl” (as if you want to draw water), and the knocking sound should be deaf, dull and painless (not the sound of clapping). In the pauses between tapping, the patient coughs up the secretion and performs breathing exercises.

Another method to facilitate the evacuation of the secretion from the bronchial tree is the suspension. They are performed while the patient is seated, but if the functional condition does not allow it, they can be performed sideways and backwards. They can be carried out in two ways. First way: The therapist places his hands on the anterolateral sides of the patient’s chest and squeezes them (making it difficult to breathe in), then asks the patient to breathe in. At the top of the inhalation, the pressure is quickly released, increasing the volume of the chest, giving an extra portion of air into the chest. the lung (audible deepening of inhalation). This technique should be performed up to five times in a series due to the risk of hyperventilation. Second, the therapist places his hands on the anterolateral sides of the patient’s chest, instructs the patient to breathe in and out, and presses on the chest at the top of the exhalation (breathing aid, audible exhalation of air); After two inhalations, it presses hard on the chest during the next inhalation and releases the pressure abruptly at the top of the inhalation. Let the patient take a few free breaths after each suspension.

Another method for cleaning the bronchial tree is effective coughing exercises. To do this, the patient breathes in deeply through the nose, followed by a long exhalation through the mouth, interrupted by episodes of short coughing, making it easier for the bronchial wall vibrations caused by pressure changes in the airways to free the bronchial tubes from clogging. The cough can be provoked by exhaling and at the same time pronouncing the word “rrrrrrrr”. . . long. or “hhhhhhh. . . ” (we don’t speak “ry ry ry” and not “chy chy chy”). This vocalization of the sounds allows additional vibrations, so that the secretion can dissolve. The exercises can be performed in the driver’s position where the patient sits with head and torso inclined forward [16] . Example exercises for effective coughing:

- sit upright- inhale- slowly incline towards the coachman when exhalation is inclined- at the top of exhalation 2-4 cough

- sit upright- inhale- slowly incline towards the coachman when 3-4 cough is inclined and the air is exhaled
- sitting upright- slow to the driver's position inclined to quickly inhale and exhale due to cough-inhale-cough-inhale-cough-inhale-cough

The next method to evacuate the secretion is to apply a positive exhaust pressure. By exhaling air for flutter or cornet the airways are vibrated and the secretion is separated [17] .

Other therapeutic options are physiotherapeutic procedures to support breathing mechanics, which take advantage of the vibration of the device (vibration massage). Devices such as Aquavibron, Fleximatic, Medex or a Vest device with a swing vest can be used to adjust chest pressure, vibration intensity and vibration frequency. The vibration can also be performed manually.

## Summary

When planning pulmonological physiotherapy, contraindications should be considered, including instability of ischaemic heart disease, congestive heart failure, increased ventricular right insufficiency, severe hypertension, severe hepatic impairment, generalised cancer, stroke with impairment, cognitive impairment. impairment, severe mental illness, drug and drug addiction, lack of exercise, unwillingness Involvement of the sick [18] .

Physiotherapy for respiratory diseases is an essential part of treatment. It shortens the time of hospitalization, empowers the patient mentally and motorically, does not make the patient afraid of activity. This is the only way to achieve better performance parameters. So far, there is no drug that can replace exercise and achieve the effects that we achieve through regular physical activity. It should be remembered that the effects of the exercises are effects of so-called controlled compensation, the effects of which diminish when we stop this control. Therefore, the activity should be adjusted according to the patient's condition and should not be discontinued for the rest of his or her life.

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