The Effect of Exercise on COPD

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Introduction

Chronic obstructive pulmonary disease (COPD) is a condition of obstructive airflow which can make it harder for you to breathe. Since The World Health Organisation estimates COPD will be the third leading cause of death globally by 2030 (1), there is a growing need for health professionals to be educated and strive to act upon this topic. The effects of COPD such as chest tightness, wheezing, shortness of breath and fatigue can have a large, negative influence on a person's daily activities and their quality of life will worsen with time. Pulmonary rehabilitation has progressed over the years to include exercise as a mechanism to cope with the symptoms of COPD. The purpose of this article is to review the importance of exercise for COPD patients and to provide insight to exercise prescriptions and the effects of different exercise modalities.

COPD Overview

The two main conditions of COPD are chronic bronchitis and pulmonary emphysema. Chronic bronchitis refers to inflammation in the bronchial tubes and restricts airflow. This leads to irritation as well as increased production of mucus and coughing. Pulmonary emphysema is a condition of damaged alveolar walls that causes them to lose their shape and creates large air spaces with reduced surface area. The loss of surface area due to damage to these air sacs results in a smaller space available for the efficient exchange of oxygen and carbon dioxide which makes oxygen transport harder and results in shortness of breath. Physical activity levels in COPD patients are lower than in healthy age-matched counterpart, but there is evidence that physical activity can enhance, health-related quality of life, gas exchange, and functional exercise ability as well as reducing dyspnea (shortness of breath) (1).

Exercise Guidelines from Governing Bodies

Governing bodies each have different recommendations of exercise prescription for COPD patients based on modes, intensity, volume and progression methods. Everyone can have a different response to exercise therefore by providing a summary of three of the leading governing bodies guidelines it will demonstrate a range of approaches that can be applied to the client's severity of COPD, motivation levels and exercise capacity to find what is best suited to them and will give the best possible results.

American College of Sports Medicine (ACSM)

Light intensities (30% - 40%) improve symptoms, health related quality of life and performance of activities of daily living, whereas vigorous intensity (60%-80%) will help to maximize physiological improvements. For individuals with a greater severity of COPD or have only just started exercising light intensity should be recommended. Starting off at a lower intensity will not only help clients acclimate to the demands of exercise but it will also reduce the stress on the respiratory muscles without eliciting dyspnea. Vigorous intensity should be applied to COPD clients whose symptoms are not as advanced as they have a reduced likelihood of complications. Performing spirometry prior to creating a program is a useful way to determine the severity of the client's condition by assessing their pulmonary function. In terms of progression those with COPD might not experience adaptions to exercise demand as quickly compared to the healthy population and you do not want to overload you client and put additional strain on the body. Judgement of the healthcare professional must be used to find a balance between progression and regression. The primary goal of resistance programs for COPD clients is to improve muscular strength and endurance so daily activities will be less stressful, which is why lower intensity recommendations are initially suggested (2).

American Thoracic Society (ATS)

Participating in frequent aerobic exercise 3-5 times per week is crucial for COPD patients as they experience restricted air flow, and this type of exercise helps to train the body to use oxygen more efficiently. Intensity is suggested to be over 60% however, exercise should not be performed at intensities higher than 80% as this can be extremely dangerous especially in endurance-based activity. Respiratory flow is limited in those with COPD therefore when challenged at meeting much higher oxygen demands over a sustained period of time the client is at a greater risk or potentially contraindicated due to hypoxia. ATS puts a strong emphasis on overload which is comprised of the FITT principle (frequency, intensity, time, type). Only one of these variables should be changed at a time so it is easy to identify what is helping the adaptions and what to avoid if not beneficial. Note that those with COPD will not be able to perform progressions to the same degree as healthy individuals. Therefore, variations should be given in smaller increments to allow to sufficient time to adapt without the risk of health concerns. For example, where you might increase duration by 10 minutes every 2 weeks in a healthy individual

only increase by 5 minutes for a client with COPD. ATS recommends that an addition focus should be given to upper limb training for muscles such as biceps, triceps, deltoids, latissimus dorsi and pectoralis as it has been found to increase upper limb function in COPD patients which makes performing everyday tasks much easier (2).

American Association of Cardiovascular and Pulmonary Rehabilitation (AACVPR)

AACVPR provides the largest range of modes out of all the governing bodies which is beneficial for COPD patients to maintain motivation due to the variety. Clients experiencing more severe COPD symptoms should start towards the 20-minute range and less severe clients should strive towards the full 60 minutes. Adapting a program based on intensity of dyspnea is an excellent choice for COPD clients as it is specific to the main symptom most struggle with and it is easily observable. Dyspnea is a fundamental marker of exercise intensity for COPD patients to use to individualize their exercise programs and experiencing the different intensities is a great way to train them to be ready and prepared for those circumstances in day-to-day life. Starting resistance training programs with low weight and high repetitions will promote muscular endurance which will help for day-to-day tasks and progressing to high weight load and low repetitions will help strength development. AACVPR recommends measuring RPE and soreness levels when making progressions in the exercise prescription. These are great tools to use as it makes the client more aware of different reference points of load and they can apply these feelings to daily activities and what the can or cannot handle. Once a clients RPE has decreased sufficiently from when they started performing at the same load it is a clear indicator that it is time to increase the intensity of the activity (2).

Exercise Mode Effect on COPD

Water vs Land Training

It has been found that exercising both on land and in water during a high intensity form of exercise will result in an improvement in functional exercise capacity as well as increased peripheral and expiratory muscle force after a duration of three months in the water-based exercise and six months in the land-based exercise (3). An increase in respiratory force demonstrates that strength of the diaphragm has increased, and the oxygen cost of breathing will decrease as a result. This is beneficial for COPD patients as their body does not have to work as hard to breath at given intensities which in turn makes tasks in daily life easier and less taxing. Felcar et al (2018) had participants complete 60 1 hour running sessions at 75% of their average

speed in the 6MWT on land and at a third of this speed on a water treadmill and found that both water-based and land-based exercise provide an improvement in the quality of life of the participants. Lastly, Felcar et al (2018) found that participants who were performing water-based activity tended to remain physically active after the study was completed. This demonstrates that there might be better exercise adherence to exercising in water for COPD patients compared to on land however, both methods are equally beneficial to improving physical activity in daily life (3).

Endurance training

Endurance exercise is beneficial for people suffering with COPD as it can help improve a range of factors such as hyperinflation, exertional dyspnea and heart rate recovery as well as counteracting muscle dysfunction (4). Support for these findings can be inferred from the study conducted by Berry et al (2018) who gave people suffering with COPD a 12-week endurance program consisting of three one-hour sessions at a 3-5 Borg scale intensity. The Borg scale is a 1-10 scale providing a rating of perceived exertion with 1 considered to be at rest and 10 at maximal exertion therefore, 3-5 would be considered moderate to somewhat hard. They found that the fatigue score and self-reported physical function both showed significant improvement after completing an endurance program. From this we can assume that the subjects found the tasks easier as the program continued due to experiencing the factors listed above to a much lesser degree. Both Daabis et al (2017) and Barry et al (2018) found that endurance training will significantly increase distance in the six-minute walk test (6MWT) in COPD participants, this is a great way of measuring functional health and aerobic fitness. Improving functional health and aerobic fitness are great ways to improve quality of life in people suffering with COPD.

Strength training

People with COPD have varying activity limitations and functionality in daily life due to their skeletal muscle dysfunction, limiting factors include muscle atrophy and weakness of their whole body (4). Strength training should be a strong recommendation for COPD patients to help them to improve skeletal muscle growth. This is because it promotes an increase in protein synthesis that is greater than the rate of muscle protein breakdown. Daabis et al (2017) found that completing an 8-week strength program consisting of two 30-minute sessions a week at 50-80% of their 1RM will significantly improve 1RM in their upper and lower body as well as providing a significant decrease in the mMRC dyspnea scale. This scale ranges from grade 0 - 4 with

dyspnea symptoms becoming more severe at higher grades. The improvement in strength and reduced dyspnea is a very distinct benefit for people suffering with COPD and will help them greatly in improving their functionality in daily life. Berry et al (2018) had subjects perform three one-hour strength sessions consisting of overhead press, bench press, triceps extensions, bicep curls as well as unspecified exercises that worked the trunk flexors, hip extensors and the extensors and flexors of the knee for a duration of 12 weeks at 80% of their 1RM. Standing up from a seated position is an extremely common action used in daily life whether this be when you get out of the car, off the toilet, from a chair or countless other examples. Improvements in this type of physical functionality are beneficial for helping them with activities of daily living and well as improving the quality of life of people suffering with COPD. It was found that this helped COPD subjects to show a trend of improvement in chair rise time. Strength programs also reap other benefits such as improvement in exercise capacity. Both Daabis et al (2017) and Berry et al (2018) found that after completing strength programs the subjects showed a significant improvement in their 6MWT from where they started at baseline. Even though the strength programs presented varied in time, duration, and frequency they both offered the same benefit in improving exercise capacity, this demonstrates that there is room for flexibility when creating programs while still experiencing the same advantages. Silva et al (2018) found that completing a purely upper limb resistance program is effective in improving functional capacity, strength, inspiratory muscle strength and quality of life in COPD patients and that the training of the peripheral musculature leads to an increase in submaximal exercise capacity and dyspnea.

Breathing considerations

Dyspnea is a debilitating symptom experienced by patients that suffer with COPD along with many more. There are a variety of breathing techniques that are commonly used by COPD patients, these include active expiration, pursed lips breathing, forward leaning, inspiratory and expiratory muscle training as well as many more. Breathing techniques are recommended for COPD patients because they work at relieving dyspnea. In their article, Gosselink (2004) highlighted this can be accomplished in three ways: 1) increasing respiratory muscle strength and endurance; 2) maximizing thoracoabdominal motion pattern; and 3) reducing dynamic hyperinflation of the rib cage and enhancing gas exchange. Body position can reduce the amount dyspnea being experienced especially if you adopt a forward leaning position because it puts the diaphragm is a favorable position on its length-tension curve which improves its force generating

and ventilatory capacity. Leaning over with arms on knees or resting on a surface support while shoulder bracing will increased engagement and efficiency of accessory breathing muscles (pectoralis major / minor) to aid in rib cage elevation significantly (8). The pursed lips breathing technique is where the subject actively expires when their lips are only half open in order to improve expiration by prolonging the process as well as preventing airway collapse. This technique improves tidal volume, oxygen saturation and respiratory rate at rest. By improving gas exchange dyspnea is reduced which is beneficial for COPD patients.

Conclusion

Both on land and in water exercise both improve quality of life and functional capacity in COPD patients. Endurance and strength training are beneficial for COPD patients as they both improve exertional dyspnea, quality of life and physical functionality. Endurance training has the additional benefits of improving heart rate recovery leading to better aerobic performance. Strength training has been found to promote protein synthesis and muscle growth as well as improving inspiratory muscle strength which can help improve muscle atrophy and weakness. Lastly, breathing techniques are very beneficial for improving the symptoms COPD improve gas exchange and oxygen saturation.

4 Elements

Apply it

- For clients who struggle maintaining an exercise regime breathing techniques can be used to enhance gas exchange and respiratory strength which improves symptoms of COPD.
- Performing initial assessments on respiratory muscle function and breathing mechanics prior to starting exercise are essential for gaining knowledge on the severity of COPD the client is facing which can influence the way the program is designed.

Bridging the Gap

Using governing bodies prescription guidelines and knowledge of the benefits different modalities can elicit is a great way to make an effective exercise program that is specifically catered to the needs of each COPD patient. Strength, endurance and water vs land exercise prescription all reduce the amount of dyspnea in COPD clients. This is one of the biggest struggles people with COPD face therefore, starting exercise should be the first step towards improving quality of life. By reviewing the variety of prescription guidelines and alternative

breathing techniques you can understand that there is room for flexibility when helping people with COPD.

Summary statement

Exercise is an essential component that helps to relieve symptoms and improve quality of life in COPD patients. This article looks at how adopting strength, endurance, water and land-based exercise programs can all help to achieve these benefits in their own ways.

Pulled text

"It has been recommended by the American Thoracic Society that using oxygen therapy alongside endurance and strength training can help to improve the benefits of exercise in people with severe COPD (2). These benefits include improved physical functionality, dyspnea, functional health and exercise capacity (5,6)".

Bio:

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