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Review

Kinesiotherapy and physical activity in COPD and Asthma Patients – A Review

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Abstract: Background: Obstructive chronic diseases are a continuous challenge for healthcare perfusionists all over the world. Asthma and Chronic Obstructive Pulmonary Disease (COPD) are the most frequent of these diseases. Respiratory or pulmonary rehabilitation started to gain momentum and it is more frequently used to improve muscle strength, cardiac and respiratory endurance and joint flexibility. The objective of this paper is to establish the current programs of physical activity or kinesiotherapy used in the past year and to reveal if there are any gaps or mismatches in the development of the program or in the instruments used to quantify the results of the rehabilitation programs. Materials and methods: We reviewed a total number of 12 articles, randomized control trials using the search words kinesiotherapy, physical therapy, COPD and asthma from the last year on PubMed.gov, from 11 different countries in order to establish which have similar types of exercises, parameters used in order to compare results and which were the outcomes. Results: The final results are positive, although it is hard to determine a unity because there were so many different parameters used to monitor the patients. The most frequent parameter was the 6MWT used to compare the effectiveness of the physical program in 6 studies. Discussion and conclusions: This review had its limitation in comparing the 12 articles researched because of the different number of patients, the various physical activity and rehabilitation exercises used, but especially because of the many varieties of scales and scores used to monitor the effectiveness of the treatment. In order to successfully compare such papers, an international guideline is necessary to relay specific rehabilitation programs for every type of respiratory pathology and also which are the most recommended scales or scores or parameters in general to asses such rehabilitation programs.

Keywords: kinesiotherapy; physical activity; physical therapy; COPD, asthma

1. Introduction

Obstructive chronic diseases are a continuous challenge for healthcare perfusionists all over the world. Asthma and Chronic Obstructive Pulmonary Disease (COPD) are the most frequent of these diseases. COPD is the third cause of death worldwide and it is a disabling condition which without proper treatment, has a severe prognosis [1]. Asthma affects a large number of both adults and children worldwide and is a cause for a large number of deaths [2].

Respiratory or pulmonary rehabilitation started gaining more points in the past years aiding significantly the modern medical treatment [3]. Effectiveness of exercises in this type

of patients, which have moderate to severe dyspnea, is individualizing the rehabilitation program according to the patients' symptoms [4]. The aim is improving muscle strength, cardiac and respiratory endurance and joint flexibility [4].

The objective of this paper is to establish the current programs of physical activity or kinesiotherapy used in the past year and to reveal if there are any gaps or mismatches in the development of the program or in the instruments used to quantify the results of the rehabilitation programs.

2. Materials and methods

We conducted a search on PubMed.gov of Clinical Trials and Randomized Controlled Trials with key search words from the last year. The key words applied were: kinesiotherapy, physical therapy, COPD and asthma.

Articles eliminated from the beginning of the search were Books and Documents, Meta-analysis, Reviews and Systematic Reviews in order to concentrate our paper on clinical trials performed and which rehabilitation therapy or physical activity in detail were applied on COPD and/or asthma patients.

This review searched for articles from the last year in order to evaluate the current level of kinesiotherapy or physical activity prescribed for COPD and asthma patients after the COVID-19 pandemic from which pulmonary and respiratory rehabilitation started to gain more notoriety.

The age of the studied patients was selected to be above 19 years-old up until to 80+ years-old. The selection did not include children and young adults under 19, although asthma in children is an increasing worldwide issue especially with the rising pollution rate [5]. This review proposed to include only adult pulmonary rehabilitation methods.

The selection included only papers written in English language.

Key words used for the PubMed search: (kinesiotherapy OR physical therapy) AND (COPD OR asthma).

Filters applied in the PubMed search: Abstract, Clinical Trial, Randomized Controlled Trial, in the last 1 year, Humans, English, Adult: 19+ years, Young Adult: 19-24 years, Adult: 19-44 years, Middle Aged + Aged: 45+ years, Middle Aged: 45-64 years, Aged: 65+ years, 80 and over: 80+ years.

After the search, PubMed found 20 articles which included the key words. After the first review of them, by reading the abstracts, we eliminated 4 articles because they were not referring to the two diagnostics mentioned in this paper asthma or COPD.

The second step was reading the full text after which another 5 papers were eliminated. These papers were referring tot one of the two conditions, but concerning the physical activity or kinesiotherapy program they were only mentioned, not detailed and the purpose of the study was another:

- The article published by Śliwka A et all. established a very interesting approach referring to music therapy aiding the medical treatment and pulmonary physiotherapy on exacerbated asthma patients, but the focus was on music therapy and the mental state of the patients which seemed to improve after this type of alternative therapy [6].
- The article published by Mihaltan F. et all. Described the Romanian cohort of the SPACE study which involved recruiting patients with COPD and evaluating their symptoms throughout different moments of the day, and also their physical activity level corelating these parameters. The physical activity was only mentioned in this paper and not detailed [7].
- Catteau M. et all. researched in their paper the effect of electrostimulation on the muscles myotube and compared results between healthy subjects and COPD patients. No physical activity or kinesiotherapy were mentioned [8].
- Chao KY et all. show in their paper the positive effect of heated humidified high-flow nasal cannula during a 6-minute walking test on COPD patients. They compared the performance of patients with and without the nasal cannula on the test and other parameters

with positive results. The patients studied were admitted in a pulmonary rehabilitation ward, but there were no details regarding the physical rehabilitation program [9].

- Zanforlini BM et all. conducted a study in their article on the effect of magnesium supplementation on COPD patients. They reviewed specific parameters in order to assess whether magnesium will improve them. The results suggested that magnesium supplementation may reduce inflammation, but as far as the other parameters including physical performance were not modified in this particular study. The physical activity or exercises were not addressed in this paper [10].

After eliminating these 5 articles we expanded the search on PubMed to 5 years in order to find other papers from the year 2021 that were suggestive for our review. We found one other paper which we added to our study selection. Thus, the total final number of papers reviewed in this article was 12, 3 of them related to asthma and 9 papers related to COPD (Figure 1).

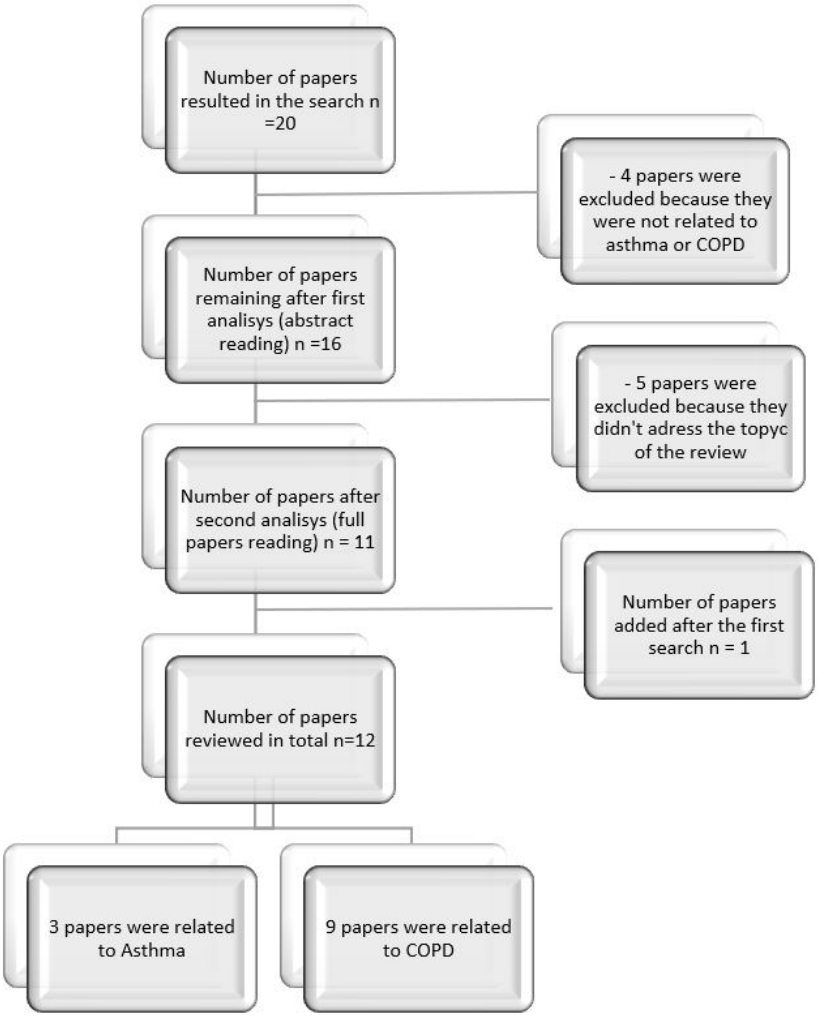

Figure 1. Study selection process

3. Results

The total number of 12 articles selected included studies performed in Tunisia [11], USA [12,13], Germany [14], Switzerland [15], France [16], Italy [17], Brazil [18], Chile [19], South Korea [20], UK [21] and Taiwan [22]. The total number of patients studied in these trials was 803. The largest number of patients in one trial was 327 [14] and the smallest one was 14 [16] (Table 1).

Table 1. Summary of study characteristics from all 12 papers included in this review

Coulson E et al. [13]	*Pancera S et al. [17]*	*Nahmias O et al. [16]*	*Gutweniger S et al. [15]*	*Geidl W et al. [14]*	*Nyenhuis SM et al. [12]*	*Tounsi B et al. [11]*	***Reference***
USA	Italy	France	Switzerland	Germany	USA	Tunisia	***Country***
ASTHMA	COPD	COPD	COPD	COPD	ASTHMA	COPD	***Type of pathology***
Short three-part exercise program or 2 breaths with incentive spirometer	Aerobic training with chest wall vibration applied during cycling	Concentric cycling (CON) and eccentric cycling (EEC)	Cycling at 60% of their maximal load on an increased ramp at 490 m and altitude of 2048 m	Rehabilitation program consisting of: exercise with mini-ergometer, callisthenic exercises,	Asthma education, Fitbit, monthly group sessions, text messages, individual step goals, and study	Endurance training program, aerobic, inspiratory muscle training program handle power	***Type of physical program***
1 month	4 weeks	1 day	2 days	6 months	24 weeks	8 weeks	***Duration of therapy***
Twice a day	Five session/week, 30 min session, twice a day	Not clearly specified	Cycling at 60 rounds until in drops to 40 for as long as possible for more that 5 seconds	Basic level – 15-25 min exercise, three times/week; High level – 30-35 min exercise, 3 to 7	Not clearly specified	30 min treadmill exercise per session, two sets of 30 breaths 4 to 5 min, with 5 to 10 min	***Frequency of therapy***
90	40	14	32	327	53	32	***Number of patients***
Asthma Control Test (ACT), mini-Asthma Quality of Life Questionnaire (mini-AQLQ), spirometry	Six-minute walk distance (6MWD) and Barthel Index based on dyspnea (BID)	VT, fB, inspiratory capacity (IC) and oxygen consumption ($\dot{V}O2$)	Duration of exercise, blood-rate, blood pressure	Actigraphy accelerometer, Saint George' s Respiratory Questionnaire (SGRQ), COPD As-	feasibility and acceptability, asthma control, quality of life, health care use, and PA levels.	The Berg Balance Scale (BBS), Timed Up and Go (TUG), single-leg stance test (SLS), Activities-	***Parameters***
at home	in hospital	in hospital	supervised	at home, with parameters monitorization and weekly calls and visits	at home, with questionnaire completed	In hospital	***Type of patient supervision***
Improvement in ACT and mini-AQLQ and FEV was lower	Increase in 6MWD	VT loer, fB higher, IC lower and ventilatory markers were lower during ECC than CON	Reduced exercise endurance – arterial hypoxemia, cerebral and muscular hypoxia, higher respir-	Increase in daily steps, SGRQ total, CAT, COPD related anxiety, fear avoidance in COPD,	improvements in asthma control and quality of life	BBS and ABC scales improved. inspiratory muscle strength (PI max) increased. No signifi-	***Outcome***

Chung Y et al. [22]	Taiwan	ASTHMA	Breathing exercises, exercises to strengthen the abdominal and diaphragmatic muscles, dynamic inspiratory efforts	12 weeks	BTE grou: 25 min session/day, twice/week, IMT group: 30 dynamic inspiratory efforts two times/day, five	60	Respiratory muscle pressure meter, boy plethysmography, Asthma Control Test (ACT), Asthma Control Questionnaire	in hospital	Increase in all scales and inspiratory muscle strength, the IMT group better than BTE group.
Daynes E et al. [21]	UK	COPD	combined IMT and high-frequency airway oscillating - HFAO device (Aerosure) or sham	8 weeks	3 times/day	96	Chronic Respiratory Questionnaire dyspnea (CRQ-D)	supervised	No difference in CRQ-D was seen between groups. Maximal inspiratory pressure signifi-
Lee SW et al. [20]	South Korea	COPD	Lung-conduction exercise – Taesikbeo, rehabilitation program: ergometer, treadmill walking,	8weeks	20 min/day, 5 times/week	16	6MWD, PFT, CAT and SGRQ	in hospital	All scales improved
Inostroza M et al. [19]	Chile	COPD	Concentric cycling (CON) and eccentric cycling (EEC)	12 weeks	Not clearly specified	20	maximal voluntary isometric contraction (MVC) strength of the knee extensors, rate of force devel-	in hospital	ECC increased LLFFM , CONC decreased LLFM, both reduced SAWT and SDWT, improved
Uzeloto JS et al. [18]	Brazil	COPD	Resistance exercises, aerobic, and functional breathing exercises	3 weeks	3 times/week, 30 min aerobic training on treadmill and resistance training	23	Medical Research Council (MRC), Chronic Respiratory Questionnaire (CRQ), Clinical	at hospital	Improvement in scales and scores, reduction of CD4+ T lymphocytes that express IL8 and in-

The rehabilitation or physical activity programs varied from study to study and the duration of the program was stretched from 1 day [16] to 6 months [14]. The physical programs consisted in cycling evaluations – 4 studies [15 – 17, 19], breathing exercises with or without breathing devices – 6 studies [11, 13, 18, 20 – 22], aerobic training – 7 studies [11 – 13, 17, 18, 20, 22] and individual programs based on different guidelines – 5 studies [12 – 14, 18, 20]. These programs were in some studies combined with each other (Table 1).
The majority of studies were conducted in hospital or another healthcare facility and three of them were conducted with patients at home, supervised throughout telephone calls, periodic visits to the medical unit and logs to write at home, promoting thus the telemedicine approach of patients [12, 13, 14].
The parameters used to evaluate the patients before and after, and in some cases in between the rehabilitation program were numerous and diverse both clinical and paraclinical tests:

- Clinical evaluation: Berg Balance Scale (BBS) [11, 18], Timed Up and Go (TUG) [11, 19], single-leg stance test (SLS) [11], Activities-specific Balance Confidence (ABC) Scale [11], Six-minute walk test (6MWT) [11, 17, 18, 19, 20, 22], quality of life [12], feasibility and acceptability [12], Saint George's Respiratory Questionnaire (SGRQ) [14, 19, 20], COPD Assessment Test (CAT) [14, 20], Patient Health Questionnaire (PHQ-9) [14], COPD-related anxiety [14], duration of exercise [15], Barthel Index based on dyspnea (BID) [17], Asthma Control Test (ACT) [13, 22], mini-Asthma Quality of Life Questionnaire (mini-AQLQ) [13], Medical Research Council (MRC) [18], Chronic Respiratory Questionnaire (CRQ) [18, 21],

Clinical COPD Questionnaire (CCQ) [18], London Chest Activity of Daily Living (LCADL) [18], Glittre Activities of Daily Living test (Glittre ADL) [18], rate of force development (RFD) [19], lower limb fat-free (LLFFM) and fat (LLFM) mass [19], tairs ascending (SAWT) and descending walking time (SDWT) [19], Asthma Control Questionnaire (ACQ) [22], Three-Day Physical Activity Log (3-D PAL) [22] (Table 1).

- Paraclinical evaluation: Maximal inspiratory pressure [11, 22], tri-axial accelerometer ActiGraph [14, 18], VT [13, 16], fB [16], inspiratory capacity (IC) [13, 16], oxygen consumption ($\dot{V}O_2$) [16], digital dynamometer [18], maximal voluntary isometric contraction (MVC) [19], PFT [20], plethysmography [22], Heart Rate [22], Blood Oxygen Saturation [22] (Table 1).

The majority of the studies divided the total number of patients in study and control groups and the results were compared between the two. All studies have a positive increase in some or all of the parameters used from beginning to the end of the rehabilitation program. Some of the studies shown better results in the aforementioned parameters when combining the type of physical and breathing exercises compared to the group which underwent just one type of exercise. The articles which studied rehabilitation in COPD maintained the medical treatment throughout the program, whereas some of the ones which studied asthma, preferred to stop the medication during the rehabilitation program.

The final results are positive, although it is hard to determine a unity because there were so many different parameters used to monitor the patients. The most frequent parameter was the 6MWT used to compare the effectiveness of the physical program in 6 studies [11, 17, 18, 19, 20, 22].

4. Discussion and conclusions

This review had its limitation in comparing the 12 articles researched because of the different number of patients, the various physical activity and rehabilitation exercises used, but especially because of the many varieties of scales and scores used to monitor the effectiveness of the treatment.

In order to successfully compare such papers, an international guideline is necessary to relay specific rehabilitation programs for every type of respiratory pathology and also which are the most recommended scales or scores or parameters in general to asses such rehabilitation programs.

Further studies on larger samples of patients with combined therapy are needed in order to improve on the respiratory rehabilitation exercises for obstructive chronic diseases.

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