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Original Article

Physiotherapy Section

The Effect of Aerobika Device and Acapella Device on Rehospitalisation and Pulmonary Functions in Patients with Chronic Obstructive Pulmonary Disease- A Systematic Review

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ABSTRACT

Introduction: Controlling and preventing symptoms of exacerbations, shortness of breath, cough and mucus in the lungs are important goals of Chronic Obstructive Pulmonary Disease (COPD) treatment. Oscillating Positive Expiratory Pressure (OPEP) devices have been shown to improve clinical results. The conservation of energy and oxygen, as well as, the prevention of lung infections and reducing rehospitalisation may be facilitated by clearing the lungs. There are several airway clearance devices, that can be used to help clear excessive sputum.

Aim: To identify the effect of aerobika device versus acapella device on rehospitalisation and lung functions in COPD patients.

Materials and Methods: This systematic review was conducted in the Department of Physiotherapy at Acharya Vinoba Bhave Rural Hospital, Sawangi, Wardha, Maharashtra, India. The duration of the study was three months, from March 2022 to June 2022. Five databases (PubMed, scopus, web of science, google scholar) were searched from 2012 to 2022. Inclusion criteria consisted of studies on the effect of aerobika device and acapella device on rehospitalisation and lung functions only in COPD patients. Data extraction included baseline features, treatment intervention, training frequency, supervision level, breathlessness, acute exacerbation, and outcomes. High quality experimental trials and comparative studies were chosen for the study.

Results: A total of 20 articles were extracted; five were utilised for the purpose of writing the review, emphasising the effect of aerobika device versus acapella device on rehospitalisation and lung functions in COPD patients. Studies had showed inconsistent results on the effect of aerobika device versus acapella device on rehospitalisation and lung functions in COPD patients.

Conclusion: Rehospitalisation, readmission and length of the stay can be reduced by using both, aerobika and acapella devices. Both devices are effective in improving lung function in COPD patients.

Keywords: Exacerbations, Physiotherapy, Pulmonary, Rehabilitation

INTRODUCTION

The COPD is a main cause of death, ranking sixth among the top 30 causes of death, according to the International Global Burden of Disease (GBD) study [1]. COPD is a major source of illness and mortality and its incidence is predicted to climb rather than decline in the coming years [2]. In India, there are currently 30 million people who have COPD, and this figure is expected to rise in the coming years [3]. Chronic cough and sputum are significant predictors for premature COPD related death and are intimately linked to recurring exacerbations [4,5]. In order to effectively manage COPD, physiotherapy must address concerns linked to lessening work of breathing, improving airway clearance, enhancing mobility, encouraging rehabilitation and aiding to provide appropriate non invasive ventilation services. Acute Exacerbations of COPD (AECOPD) are clinically significant events, that have been shown to reduce the Quality of Life (QoL), lung function, healthcare utilisation and mortality [6-9]. Trainings to remove mucus from the airway may help, and early treatment can speed up recovery [10]. OPEP devices, such as the aerobika and acapella, are non pharmacological interventions that promote sputum clearance by providing significant pressure to maintain airways open and airway oscillations to thin mucus and have less side effects than pharmacologic therapy [11,12].

The aerobika device is a drug free, portable medical equipment that has been shown to help COPD patients achieve better their lung performance and overall health related life satisfaction [13]. COPD patients who utilised the aerobika device had a remarkable reduction in exacerbations requiring Emergency Rooms (ER) visits and hospitalisations, according to a recent observational study [14]. Patients experiencing exacerbations of COPD symptoms regularly visit ER and may need to be admitted to the hospital [15]. Acapella device produces a variety of flow, pressure, and frequency outputs. The greater the expiratory flow bias and consequently the greater the secretion clearance, the higher the maximum expiratory flow in respect to the maximum inspiratory flow [16]. The resistance parts in the acapella device cause short and successive disturbances in the airflow, resulting in the production of positive pressure and vibration during expiration. These variables aid in the mobilisation of bronchial mucus. It also prevents alveolus collapse during the expiration phase, which enhances the incidence of expectoration and clears the respiratory tract. The aim of present review was to identify the effect of aerobika device versus acapella device on rehospitalisation and lung functions in COPD patients.

MATERIALS AND METHODS

The present systematic review was conducted in the Department of Physiotherapy at Acharya Vinoba Bhave Rural Hospital, Sawangi, Wardha, Maharashtra, India. The duration of the study was three months, from March 2022 to June 2022. It was registered in the Clinical Trial Registry-India (CTRI) with the registration number

CTRI/2022/06/043311. Five databases (PubMed, scopus, web of science, google scholar) were searched from 2012 to 2022. The following criteria were used to choose these review articles: english language publication, articles published within the last ten years, healthy subjects and survey design, including literature reviews. These articles were chosen based on their content, rather than their location. Articles, on the other hand, were exempted due to the fact that, they were composed in languages other than english, had been published for more than ten years, were non human trials, and were meta-analyses or systematic reviews.

Inclusion criteria: Studies on the effect of aerobika device and acapella device on rehospitalisation and lung functions only in COPD patients. Data extraction included baseline features, treatment intervention, training frequency, supervision level, breathlessness, acute exacerbation and outcomes. High quality experimental trials and comparative studies were chosen for the study.

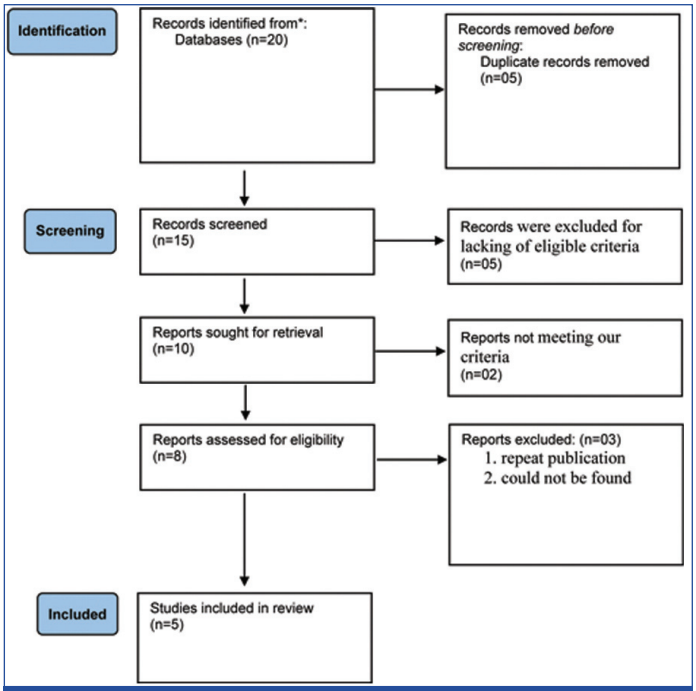
Exclusion criteria: Patients who were mechanically ventilated and intubated were excluded from participating in potential trials because the respiratory mechanics, results, and demands of physiotherapy differ for these patients from those who are self ventilating [17]. Additionally, studies were eliminated if they involved patients who were unconscious or unable to actively engage in physiotherapy interventions.

Study Procedure

Search method: Five databases (PubMed, scopus, web of science, google scholar) were searched by using regular keyword search for publications that displayed studies addressing COPD, acapella, aerobika, acute exacerbations, rehospitalisation, lung function and physiotherapy. Numerous papers, considering editorials, review articles, free full texts, and abstracts, were found through the search. After a thorough review, applicable articles and their references were used to perform a search for other publications. A total of 20 articles were searched, related to efficacy of aerobika device and acapella device [Table/Fig-1,2] in rehospitalisation and lung function in COPD patients. Five articles were identified appropriately as per the inclusion criteria. [Table/Fig-3] is showing the prisma flow diagram explaining the process of inclusion of articles.

[Table/Fig-1]: Aerobika device-Lupin aerobika OPEP device (1 pcs) dimensions: 15×5×20 cm).

[Table/Fig-2]: Acapella device-BIONICS (green code).



[Table/Fig-3]: Summary of included studies (n=5).

Study selection: Relevant articles were chosen for full text reading after titles and abstracts were reviewed. Two authors looked over the search results and decided the final list of articles that would be included before this. The included articles were not biased.

Interventions: The protocols for the trials that were included differed in terms of how various airway clearing devices were used, breathing exercises, exercise type, frequency and intensity. Moreover, the studies that were included, involved examination following exercise: Post discharge hospital admissions, pulmonary function test and QOL. Exercise programs contained pursed-lip breathing, diaphragmatic breathing, thoracic expansion, Active Cycle of Breathing Technique (ACBT), active limb mobility exercises, ambulation and use of aerobika or acapella device.

Outcome measures: The outcome measures were post discharge hospital admissions, spirometry tests, Functional Respiratory Imaging (FRI), Pulmonary function test (FEV1 and FEV1/FVC), six minute walk test and QoL. Kaplan-Meier survival analysis was used to assess the length of time between discharge and disease related readmission. For 1:3 Propensity Score (PS) matched aerobika and acapella users, readmission rates were calculated at 30 days and 12 months following discharge.

Data extraction: Two authors read the articles and abstracted the data independently and data were recorded. Outcomes that concentrated on were post discharge hospital admissions, pulmonary function test and QoL. The authors summarised the information for each study in the list, e.g., authors, publication year, number of participants, specific method of exercise, outcome measures and result.

Risk of bias: The Physiotherapy Evidence Database (PEDro) scale was utilised to evaluate the methodological quality of all included trials [18]. If all conditions are met, PEDro gives a score of ten points. The PEDro scale criteria were independently applied by two assessors Vibration-translation and Vibration-vibration (VT and VV). The quality assessment was not used to exclude any trials, but it was considered when interpreting the findings. Trials were deemed to be of inferior quality, if they received a PEDro score of less than four out of 10.

RESULTS

A total of 20 studies from which five were finally included in the present review based on inclusion and exclusion criteria. The five

primary publications that reported on effectiveness of aerobika and acapella device in COPD patients were included in the present review. A retrospective cohort study was done by Tse J et al., comparing the use of the aerobika and acapella devices on post discharge hospital admissions in chronic bronchitis or COPD patients and concluded that, patients who delivered the aerobika OPEP device had lower rates of recurrent severe illness aggravation and hospital admission than those who received the acapella device [19]. Another study done by Leemans G et al., on analysing the efficacy of an OPEP device in COPD showed that, the utilisation of the aerobika device to improve airflow, which influences the patterns of concurrent prescription drug deposition in COPD patients [20].

A study done by Shamakh M et al., on the implications of portable positive expiratory pressure versus acapella on pulmonary functioning in the treatment of COPD and concluded that, both can improve the lung functions of people with moderate COPD. ACBT alone improved performance, but only to a lesser degree than acapella and OPEP [21]. Another study done by Suggett J et al., comparing the effectiveness of two OPEP devices in patients with chronic bronchitis or COPD on readmissions to hospital after 30 days and one year and concluded that, when compared to another OPEP device, the aerobika device had a longer time to readmission. This endorses the utilisation of the aerobika device as a supplementary to standard postexacerbation care and highlights differences in the effectiveness of OPEP devices [22].

Another study done by Burudpakdee C et al., on exacerbation outcomes in COPD patients taking aerobika device for 30 days and concluded that, COPD patients who were prone to exacerbations in the past, by utilising aerobika device as part of a therapy programme may help reduce readmissions to the hospital, emergency department visits and associated expenses [14]. High quality Randomised Clinical Trial (RCT) should be performed to find out the effectiveness of aerobika device versus acapella device on rehospitalisation and lung functions in COPD patients. [Table/Fig-4] is showing the summary of included studies [14,19-22].

DISCUSSION

The results of the present trial, like many others was difficult to compare in a single phrase declaring whether the aerobika device or the acapella device is more beneficial. The findings were mixed, and it is clear that many of the included trials have low methodological quality and use a wide range of outcome measures. However, it suggests that, the various airway clearing devices utilised in several of the featured trials have comparable outcomes when compared to other treatments with a limited scope. When compared to more conventional techniques such as ACBT, the outcome is conflicting. Three trials showed similar effects of aerobika device on reduction in readmissions to the hospital [14,19,22], one other trial presented an effect of aerobika device improve airflow, which influences the patterns of concurrent prescription drug deposition in COPD patients [20]. While one trial showed similar effect of improvement in the lung functions of people with moderate COPD, when acapella device is combined with ACBT [21]. Various studies showed a positive effect of aerobika device and acapella device in different outcome measure i.e., post discharge hospital admissions, spirometry tests, FRI, pulmonary function test (FEV1 AND FEV1/FVC), six-minute walk test and QoL [19-22]. In clinical practice, a variety of airway clearing devices and administration procedures are employed. Several devices with varying durations were studied in the present study. The aerobika device was tested in four trials, and the acapella device was evaluated in one trial.

A wide range of outcome measures were also used in the included trials. The majority of the trials were concentrated on various lung function tests. Only three of the trials focused at characteristics related to hospital stay length, which is an important variable from the view point of health economics. The trials variability makes condensing the data even more difficult. The use of aerobika device and acapella device with combination of other chest physiotherapy techniques in patients with COPD has been intensively studied and concluded that, it improves lung function and reduce chances of readmissions to the hospital and symptoms of acute exacerbation. It is essential for COPD patients to be able to choose between different medications for different symptoms, but it is also crucial to increase patient compliance. One of the benefits of airway clearance

Author (year)	Sample size	PEDro score	Intervention	Outcome measures	Result
Tse J et al., (2020) at Trudell Medical International, Science and Technology, London, Ontario, Canada [19]	5029 patients	8	Aerobika device and acapella device	Post-discharge hospital admissions	Patients who delivered the aerobika OPEP device had lower rate of recurrent severe illness aggravation and hospital admission than those who received the acapella device.
Leemans G et al., (2020) at Trudell Medical International, London, Ontario, Canada [20]	10 patients	8	Using the OPEP device atleast twice a day before starting their treatment programme.	Spirometry tests and Functional Respiratory Imaging (FRI)	The utilisation of the aerobika device to improve airflow, which influences the patterns of concurrent prescription drug deposition in COPD patients.
Shamakh M et al., (2020) at Quintiles IMS, Fairfax, VA, USA [21]	60 patients	9	Active Cycle of Breathing Technique (ACBT), Positive Expiratory Pressure (PEP) on acapella	Pulmonary function test (FEV1 AND FEV1/FVC), six-minute walk test and QoL	Both, ACBT and acapella device can improve the lung functions of people with moderate COPD. ACBT alone improved performance, but only to a lesser degree than acapella and PEP.
Suggett J et al., (2020) at United states [22]	2476 patients	8	Aerobika device and acapella device	Kaplan-Meier survival analysis was used to assess the length of time between discharge and disease related readmission. for 1:3 Propensity Score (PS) matched aerobika and acapella users, readmission rates were calculated at 30 days and 12 months following discharge	When compared to another OPEP device, the aerobika device had a longer time to readmission. This endorses the utilisation of the aerobika device as an supplementary to standard postexacerbation care and highlights differences in the effectiveness of OPEP devices.
Burudpakdee C et al., (2017) at Cairo, Egypt [14]	810 patients	7	Aerobika device	A Generalised Liear Model (GLM)	The COPD patients who were prone to exacerbations in the past, by utilising aerobika device as part of a therapy programme may help reduce readmissions to the hospital, emergency department visits, and associated expenses.

[Table/Fig-4]: Summary of the included studies. [14,19-22].

devices is that they allow patients to be more self-sufficient in their treatment. Training can be done whenever the patient has time and may be less time intensive than conventional physiotherapy [23].

Limitation(s)

The authors recognised that, there were fewer publications included due to publication bias. No meta-analysis of the forest plot was done keeping in mind the heterogeneity in the population. Future recommendation for both, aerobika and acapella devices are effective in reducing rehospitalisation and improving lung function in COPD patients. Both the devices can be used in postexacerbation care.

CONCLUSION(S)

According to the finding of all the literature, both aerobika device and acapella device can reduce length of stay in hospital and readmission. Both the devices are effective in clearing secretions and improving lung function in COPD patients, and can be used in postexacerbation care.

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