



Effectiveness of aerobika on chronic obstructive pulmonary disease: A scoping review

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Abstract

Background: COPD is one of the commonest disorders around the world and the causes of morbidity and mortality. Acute COPD symptoms can be managed medically. For severe exacerbations, hospitalisation may be required. OPEP devices, have been shown to help in COPD exacerbation. AEROBIKA® is a portable mechanical OPEP device in which patients blow against a variable resistance that is manually adjusted. It prevents the alveoli from collapsing. Various OPEP devices can help patients with stable COPD not only clear mucus but also improve short-term lung capacity, agility, and QOL. Aerobika has been shown to enhance (FVC), (6MWD) in COPD patients.

Aim: To review the accountability of effectiveness of aerobika® in patients with COPD.

Method: In this scoping review articles are researched from the search engines like PUBMED. These articles are reviewed according to the inclusion criteria which include last 6 years of articles, experimental and pilot study, observational, retrospective cohort study. 10 articles were selected according to it.

Result: Articles selected for the review are research studies conducted on aerobika®, COPD, familiar comorbidities, post-surgical patients. All studies assessed for the review showed a significant positive effect on the COPD patients who used the Aerobika®.

Discussion: The discussion is based on the results of all the 7 articles included in this review. Among them all the 6 articles have individually stated that aerobika® have been proven to be clinically effective in the treatment of post exacerbation COPD patients. Aerobika® in comparison to other OPEP devices have lower rates of severe disease exacerbation in COPD patients.

Keywords: aerobika®, COPD, sputum clearance, exacerbation

Introduction

COPD is a complicated condition ^[1]. Chronic respiratory problems are one of the most common. These days, COPD is the leading cause of illness, mortality, and financial costs ^[3]. Lung cancer and cardiovascular illnesses are the leading causes of death in mild and moderate COPD, but respiratory failure is the leading cause of death in new contemporary COPD (FEV1 less than 60%) ^[4]. Nonetheless, cardiovascular events account for around 20% of all deaths in people with modern COPD. Coughing up mucus owing to mucus hypersecretion is a common symptom of COPD ^[8]. Osteopenia and osteoporosis, glaucoma and cataracts, cachexia and malnutrition, peripheral muscle dysfunction, cancer, and the metabolic syndrome are all common comorbidities associated with COPD. COPD is a rapidly progressing, yet incurable disease characterized by severe respiratory symptoms and airflow restriction caused by airway or alveolar irregularity, which is usually induced by significant exposure to noxious particles or gases ^[14]. Infectious (bacteria and viruses) and environmental (air pollution and meteorological effect) components combine to activate COPD. Exacerbations are likely to occur if the dynamic equilibrium between 'pathogens' (viral and bacterial) and the usual bacterial populations that make up the lung microbiome is disrupted ^[15]. The most significant driver of increased healthcare expenses is hospitalisation ^[16], with approximately one in every five patients requiring re-hospitalization within one month of discharge ^[17]. It is distinguished by acute irritability of manifestations such as increased sputum production, airway inflammation, and breathlessness, which occur most frequently during functional activities that place stress on the pulmonary system, such as walking upstairs, fast walking, and walking long distances ^[18] and necessitate supplemental therapy. Emergency sector visits and care are required in critical cases ^[19]. A demonstration of the concept Salbutamol treatment, airway stent placement, and acute exacerbation therapy have all been shown to improve ventilation in COPD studies. COPD-related hospitalizations are expected to increase by 210 percent by 2030, compared to 2010 values ^[3]. In severe exacerbations, arterial blood gases should be considered to describe respiratory failure. Acute COPD management may include the use of bronchodilators, steroids, antibiotics, oxygen, and non-invasive ventilation, depending on the severity of the condition. For severe exacerbations, hospitalisation may be required. In patients with current COPD, nonpharmacological interventions such as disease-specific self-management, pulmonary rehabilitation, early medical follow-up, home visits by respiratory health workers, combined programmes, and telehealth-assisted hospital at home have been carefully considered throughout hospitalisation and shortly after discharge. COPD is an airway disease

characterized by obstruction of expiratory airflow due to accumulated secretions, thickening of the mucosal membrane, and Bronchus tapering due to smooth muscle spasm. These substances may decrease the proportions of the bronchial lumen, increasing the resistance to expiratory airflow ^[15]. GOLD recommendations presently recommend smoking cessation, pharmacologic therapy, and recovery for people with COPD. Oscillating positive expiratory pressure (OPEP), a drug-free airway clearance method, has been advanced to supply interest in COPD patients through opening airways and mobilizing bronchial secretions with higher sputum ^[17]. Aerobika®, acapella, flutter, medic plus, shaker, Pari PEP, RC-cornet, lung-flute have all been used in everyday life to improve lung function, eliminate excessive sputum from the airways, improve quality of life, help patients breathe comfortably, and minimize lung infections. OPEP devices, in addition to antibiotics, bronchodilators and inhaled steroids, have been shown to help in COPD exacerbation ^[18].

AEROBIKA ® is a portable mechanical OPEP device in which patients perish against a variable resistance that is manually adjusted ^[1]. The Aerobika device is made up of three parts: a top case, a bottom case, and a valve cartridge. Aerobika ® is a low-cost OPEP device that has been described as widely utilised in COPD treatment. Aerobika ®, like other OPEP devices, has various limitations in terms of physical functionality and treatment extent adaptation ^[17]. OPEP devices are pocket airway clearance devices that work on the theory that high-frequency oscillations during expiratory flow cause shear forces, which reduce secretion viscoelasticity and increase mucus transfer.^[19] Positive pressure allows air to enter the peripheral airways via collateral channels, allowing it to pass through the secretion and into the larger airways, where it may easily be expelled. OPEP prevents the alveoli from collapsing ^[8]. Scientific research suggests that various OPEP devices can help patients with stable COPD not only clear mucus but also improve their short-term lung capacity, exercise ability, and quality of life. While supplementary therapy with OPEP devices may provide additional benefit to COPD management, one database analysis found that the Aerobika OPEP device reduced 1 month exacerbation by approximately 30% as compared to no PEP or OPEP device after a hospital stay ^[21].

Moreover, effective dissimilarities between a small number of OPEP devices, as disclose by several laboratory studies using replicate lung models, which may impact clinical efficacy. In exceptionally the Aerobika ® OPEP device has been in view to have the most compatible pressure magnitudes at higher resistance settings, and excessive total pressure pulse impact differentiate to acapella and OPEP devices ^[2]. Aerobika has been shown to remarkably enhance forced vital capacities (FVC), 6-min walk distance (6MWD) in COPD patients ^[19].

Material and Method

The aim was to study and summarize the findings in the articles on effectiveness of AEROBIKA on COPD: A Scoping Review. This review was carried out by searching in the databases including PubMed search was done using the following keywords combination; COPD, Sputum clearance, exacerbation, aerobika. An internet search was also conducted to retrieve literature not available through usual databases. The search was conducted over scoping reviews on Effectiveness of aerobika on COPD. Articles included in the study were from last 6 years. The inclusion criteria were, 1) articles including COPD, 2) Full text articles, 3) Observational study, 4) Published articles. The exclusion criteria was as follows; 1) Duplicate articles; 2) unpublished articles; 3) Device other than aerobika 4) articles with only abstracts.

Search Strategy

Articles were selected by searching databases including, PUBMED, using the keywords COPD, Exacerbation, Aerobika®. Considering the inclusion and exclusion criteria, 10 articles were selected for reviewing. 3 articles were excluded as they did not meet the inclusion criteria for scoping review.

Search Outcome

The search resulted in 7 articles after meeting the inclusion and exclusion criteria therefore 7 articles were selected for the review.

Result

After the application of our inclusion criteria to 10 identified articles; total 7 studies were screened after the removal of duplicate article and article that did not included COPD; 7 articles were judged to be relevant and ultimately 7 articles were accepted as scientifically admissible.

In 7 studies conducted on effectiveness of Aerobika® on Chronic obstructive pulmonary disease have been included, according to Jason A Suggett and Dominic P Coppolo efficacy of the Aerobika ®device in the population without any PEP or OPEP therapies compared with the population who used in one-month post-exacerbation. The use of the Aerobika® device in the post-exacerbation population was found more commanding ^[1]. Now according to Jenny Tse, Keiko Wada they coordinated all the properties of the Aerobika® device and Acapella device users. They found out that sufferers in both the cohorts were 72 years old, and more than fifty percent of the sufferers were females (54-55%). Familiar comorbidities were hyperlipidaemia (56.7%) of the Aerobika® device cohort and (57.3%) of the Acapella cohort, cardiovascular disease (44.1%) and (43.2%) and anxiety/depression (35.9%) and (35.1%). Concerning one-fourth of sufferers also had oxygen therapy (29.4% of the Aerobika® device cohort and (26.6%) of the Acapella cohort). In comparison to the aerobika® and acapella users' people who used the aerobika® OPEP had remarkable prolonged hours to critical illness exacerbation ^[2]. As per the Chakkarin Burudpakdee between 1 September 2013 and 30 April 2017 a total

number of patients that were hospitalized were 887 cardiac, thoracic, and upper abdominal surgery patients that were associated to have used the Aerobika ® device. After the selection criteria was applied 152 samples consisted of sufferers who used Aerobika ® device and 3922 sufferers used incentive spirometry (IS). After the propensity score (PS) a total number of 144 Aerobika ® device users were found. At 30-day post discharge there were notably lesser sufferers in the Aerobika ® OPEP cohort than in incentive spirometry cohort. Roughly 20% of population with incentive spirometry users had a re-admission compared with Aerobika ® that had 11.1% sufferers. Post-discharge period was small for Aerobika ® device users compared to incentive spirometry users on mean of extent of visit throughout [3]. As stated by Avery Tung, the expiratory flow needed to give rise to the same expiratory pressure threshold varies greatly among devices. Valved OPEP devices such as VibraPEP need less flow than mechanical devices such as Aerobika ® and acapella [4]. James R Walsh had made an outcome on comparing the performance characteristics of different positive expiratory device that for peak PEP bigger flows developed in higher peak PEP presented by all devices excluding the acapella, for which peak PEP lessened only at higher flows (25-30L/min) significant peak PEP over all flows was indicated by the Aerobika ®. Increasing resistance increased peak PEP produced by the Acapella, Aerobika, and Pari PEP, but followed in slightest substitute in peak PEP for the Flutter and Acapella. The Aerobika gave rise to the considerable peak PEP in general at moderate and high resistance, and the Pari PEP made the shortest peak PEP in general at low and moderate resistance [5]. William Poncin has compared the 6 oscillatory positive expiratory pressure devices during active respiratory flow and has claimed in this study that increase in the mean PEP, Ppeak, and oscillation cycle in all devices increases resistance frequently. Consequently, increasing the resistance quantity lessens oscillation amplitude in all devices with the peculiarity of the Aerobika, where oscillation amplitude increases from small to moderate resistance and then remained stable at high resistance setting. changing the resistance situation of the Flutter, the Gelomuc or the Pari device had alike effect on mechanical variables, although the magnitude of substitute was significant with the Shaker device. In compared to the other OPEP devices, big oscillation amplitude values at moderate and high resistance levels whereas Aerobika ® made the lowest PEP, Ppeak, and oscillation frequency use at all resistance settings [6].

Outcome

In total, six outcomes were investigated:

According to Jason A Suggett, using the aerobika® device resulted in a 20% reduction in exacerbation over the course of one month (from 0.72 to 0.58), as well as improved clinical benefit and fewer estimated exacerbations. As a result, the aerobika ® device remained the most popular technique. The disadvantage was that there was few published research on the use of OPEP devices in the therapy of COPD [1].

According to Jenny Tse, patients who had at least one severe exacerbation after discharge were less likely to utilise the aerobika ® device than those who used the acapella device. Aerobika ® users reported 17 percent fewer exacerbations with patients who experienced severe exacerbation than acapella users. Improved airway clearance also improves the prognosis of illness aggravation. The harm observed in this study was whether patients used the OPEP device with proper techniques or with the appropriate frequency if the devices were used with nebulizers, or what other physiotherapy treatments (e.g., breathing programmes) were administered, all of which could affect device efficacy and outcomes [2].

Chakkarin Burudpakdee *et al* in their study, found that using the aerobika ® OPEP device in COPD patients improved outcomes such as opening up the airways, mobilising and removing mucus, and increasing medication deposition. They also discovered that using the aerobika ® OPEP device was related with fewer visits to emergency rooms, fewer hospital admissions, and lower costs. The favourable effects of the Aerobika ® OPEP device on enhancing the airway structure and function have resulted in a reduction in the chance of developing a post-pulmonary complication in post-operative patients. The study had significant flaws, including the inability to determine a cause-and-effect relationship. The database does not contain relevant laboratory values or patient vitals. The study underreports medications provided at community and retail pharmacies [3].

According to Avery Tung, devices that require a greater flow rate to provide therapeutic end-expiratory pressures, such as the vPEP, Acapella, and Aerobika device, may be most suited to obese patients who can generate the expiratory flow rates and exhaled tidal volumes required by those devices. OPEP devices that can provide a suitable airway pressure with lower expiratory flow rates may be able to enhance the potential benefits of OPEP therapy for thinner patients.

According to the findings of this study, elderly patients or those with obesity, chronic congestive heart failure, and restrictive lung and chest wall disorders may not be able to generate the expiratory flow rates needed to maintain the target expiratory airway pressure, and excessive use of the OPEP device can increase work of breathing and lead to hypoventilation and hypercarbia.[4] According to James R Walsh, Aerobika ® appears to be a flow-dependent device in this investigation because increased flow resulted in higher mean PEP production. Across all flows, Aerobika ® has the highest overall peak PEP and amplitude PEP. The study's weakness is that in practical practice, the operating features of the devices alter during expiration, therefore the devices' influence on airway clearance may vary [5].

According to William Poncin, Aerobika exhibited larger oscillation amplitude values at medium and high resistance settings. The inability to recreate body temperature and pressure saturation situations was a drawback. Humidity and heat, on the other hand, may alter the behaviour of the OPEP device over multiple breaths, as has been demonstrated in clinical practice [6].

Discussion

Summary of Results

This scoping review aimed to provide an overview of the current evidence on effectiveness of Aerobika® in COPD.

Discussion of Result

Concerning Aerobika® in COPD previous studies have proven that Aerobika® OPEP is founded to be more effective in post-exacerbation population in comparing with other OPEP devices and also helps in mobilizing and clearing the mucus build-up from the airways. Aerobika® also reduces the hospital readmission. Aerobika® OPEP device in the treatment of COPD have more efficacy than other OPEP devices. No adverse effects were noted due to the use of Aerobika® OPEP.

Jason A Suggett resulted that the study suggest that device will provide effective therapy for post-exacerbation COPD sufferers and exhibited Aerobika® as the controlling strategy. Aerobika® device improves manifestations and alleviate the danger of re-exacerbation in patients with COPD^[1].

Jenny Tse in their study suggested that Aerobika® and acapella both the cohorts were used, those patients who used both the cohorts were mostly females and were elderly that is 75 years and above. After using both the cohorts they were compared in the similar sufferers they have noticed that patient with COPD or chronic bronchitis who used the OPEP device such as Aerobika® and acapella, it has been noted that patients using the Aerobika® OPEP device have least chance of getting hospitalized and having disease within one month. In respect with the Aerobika® and acapella device a number of studies have described finer implementation connected to the airway clearance^[2].

The Chakkarin Burudpakdee had proposed in his study that Aerobika® device in merge with the incentive spirometry in post-operative cardiac, thoracic, and upper abdominal surgery patients they have found that compared to patients who only met with incentive spirometry during hospitalization and patients who used the aerobika® OPEP device in addition receiving incentive spirometry were had lesser amount of probability to have all cause hospital readmission, had a small period of stay during readmission. Aerobika® OPEP device is a cheap, drug free treatment that can stop post-pulmonary complication and lessen the hospital cost. Aerobika® OPEP device is perhaps advantageous when used as standard of care in all post-operative patients^[3].

As per the Avery tung in his study found out that expiratory pressure of >10cm H₂O is caused due to expiratory flow conditions. His discovery proposes that children or those with restricted expiratory airflow due to disease such as COPD, obesity, chronic congestive heart failure and restrictive lung disease could have better outcome using OPEP devices.

Valved OPEP devices such as VibraPEP need less flow than mechanical devices such as Aerobika® and acapella devices to cause an expiratory airway pressure of >10cm H₂O. The details also indicate that not all OPEP devices are acceptable for all patients. Devices such as acapella and Aerobika® possibly be suitable for younger and older patients allowed to generate the expiratory flow rate and exhaled tidal volumes and need to increase flow rate to give rise to therapeutic-end expiratory pressure needed by those devices. For children sufferers OPEP devices able to bring out a proper airway pressure with lower expiratory flow rates may improve the potential welfare of OPEP therapy^[4].

James R Walsh in his study claims that there are portable but notable feature of the devices over the resistance settings, increase in the mean PEP caused by all devices increases the resistance. In this study Pari PEP made the considerable general mean PEP at moderate and high resistance, this perhaps due to the Pari PEP being the non-oscillatory device with the irregularity of the Acapella, all devices caused a mean PEP > 10 cm H₂O at moderate to high resistance settings. All devices made peak PEP > 10 cm H₂O over all resistance settings except the Pari PEP, which needed moderate to high resistance settings. progressively, the Pari PEP made the least peak PEP at low and moderate resistance settings in compare to other devices, and the Aerobika caused the greatest peak PEP and amplitude PEP at moderate and high resistance settings^[5].

According to William Poncin in this study have differentiate the mechanical properties and execution of 6 commonly used OPEP devices in concern with different lung disease seriousness. The devices were chosen on the ground of their capacity to be accurately disinfected, which is an essential for devices used with subjects open to lung infections, such as sufferers with cystic fibrosis. The outcome indicates that the Flutter, Gelomuc, and Pari OPEP devices made best mechanical variables to aid the airway clearance. In difference, the Acapella, Aerobika, and Shaker devices were not similar in respect to their mechanistic parameters. Not only they did not answer comparably to different operational conditions, but they were also less susceptible to make oscillation frequencies > 12 Hz while maintaining a PEP value of >10 cm H₂O. nevertheless, the Aerobika caused higher oscillation amplitude values at moderate and high resistance settings^[6].

Strength and Limitation

Certain limitations were observed while proceeding with the study.

In this study, among all the reviewed articles, there was minimum evidence regarding COPD.

The limitation observed in this study was, among all the reviewed articles there was minimum evidence regarding COPD. Aerobika® was used in conditions such as cystic fibrosis and bronchiectasis and various

operative conditions such as cardiac, abdominal, and thoracic surgeries instead of using in Chronic obstructive pulmonary condition.

Future Scope

Physical therapy has potential impact and positive results were obtained in all the studies which were taken into contemplation for this scoping review. The result and discussion ultimately hint towards its positive impact on the improvement of condition of COPD by using the Aerobika® OPEP device. Promising results can be predicted for future studies which will be conducted on COPD patients or sufferers by using the Aerobika® OPEP device.

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