AEROBIKA* OPEP DEVICE - CLINICAL SUMMARY

AUGUST 2023

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Overview on the Aerobika* Oscillating Positive Expiratory Pressure (OPEP) device

Why use the Aerobika Oscillating Positive Expiratory Pressure (OPEP) device?*

The ***Aerobika**** OPEP device is a drug-free and easy to use device that can help to clear excess mucus in the airways and improve breathing.[1]

The ***Aerobika**** device has an innovative pressure-oscillation mechanism that creates positive pressure pulses when a patient exhales. The positive pressure created can assist with opening weak or collapsed airways.[1] The ***Aerobika**** device also produces vibrations in the airways that can help to think and loosen mucus, naturally moving it to the upper airways where it can be coughed up easily.[2]

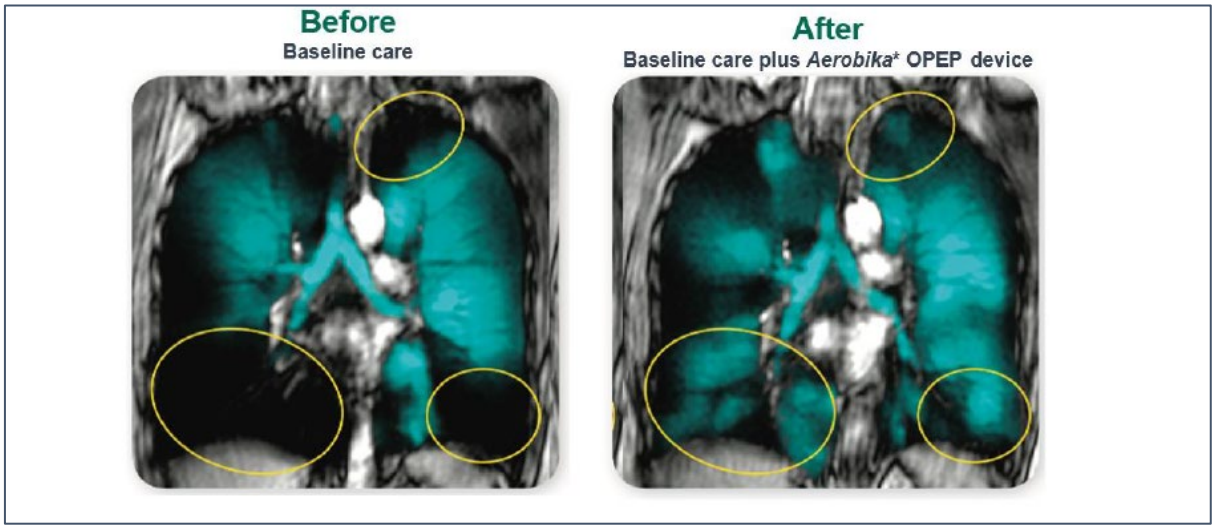

Figure 1: OPEP Therapy Improved Lung Ventilation in COPD Patients

Teal colour and intensity show areas with gas distribution. Yellow circles represent areas of greatest change after 3-4 weeks of Aerobika* OPEP device use. Demonstrated by hyperpolarized 3He magnetic resonance imaging (MRI).

The ***Aerobika**** device can be used to manage respiratory conditions such as Chronic Obstructive Pulmonary Disease (COPD), bronchiectasis, and Cystic Fibrosis (CF).

OPEP Inclusion in Guidelines

New GOLD Recommendation for Mucus Management in COPD

The GOLD COPD guideline recognises mucus clearance treatments that promote mechanical movement, such as OPEP, to help clear mucus.[3]

Lung health depends upon effective mucus clearance. In disease states, thick and viscoid mucus can lead to airway inflammation and infection. Cough and dyspnoea are the principal symptoms of impaired mucus clearance.

Exacerbations of COPD (ECOPD) are episodes of acute respiratory symptoms worsening often associated with increased local and systemic inflammation. ECOPD are key events in the natural history of the disease because they impact significantly on the health status of the patient (often for a prolonged period of time), enhance the rate of lung function decline, worsen the prognosis of the patient, and are associated with most of the healthcare costs of

COPD. The best predictor of having frequent exacerbations (defined as two or more exacerbations per year) is the previous history of exacerbations.[3]

GOLD has proposed an updated to the previous version with a combined assessment tool that recognises the clinical relevance of exacerbations, independently of the level of symptoms of the patient. This further supports the value of the ***Aerobika**** device which has been shown to reduce COPD and bronchiectasis exacerbations.[3]

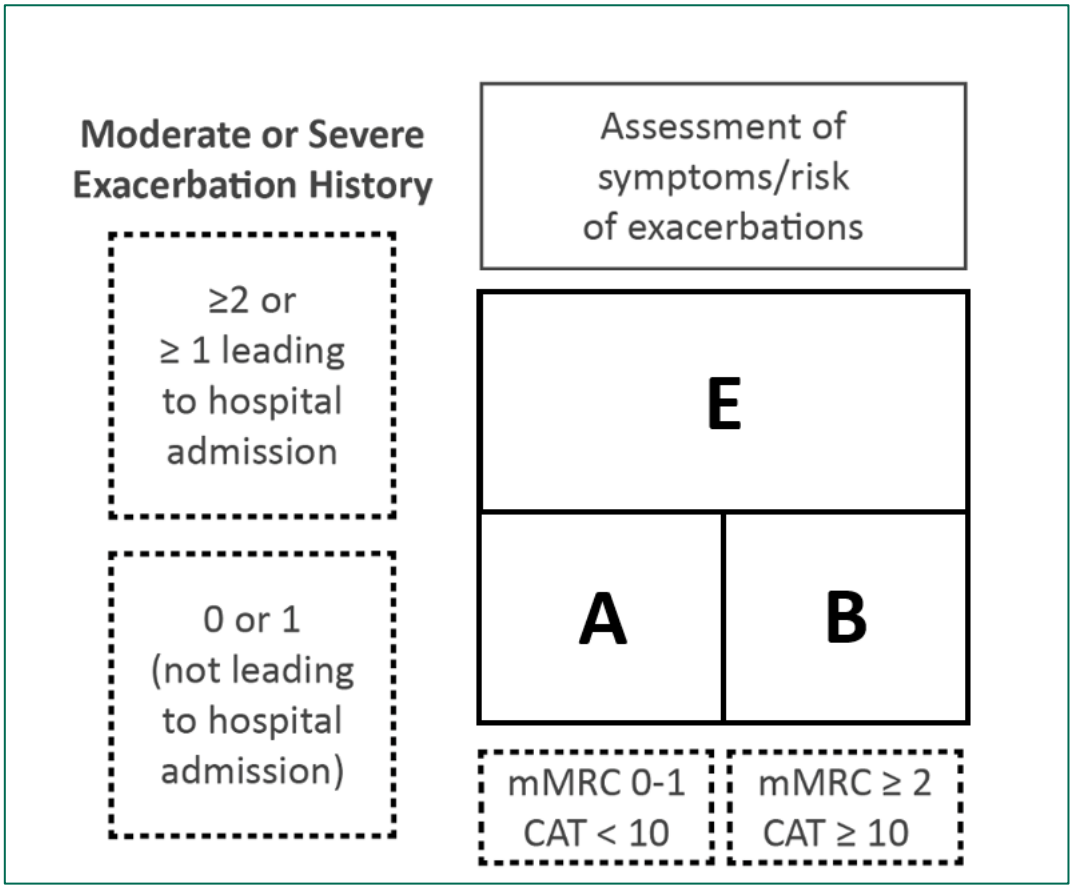

Figure 2: GOLD 2023 ABE Assessment Tool

In addition, the treatment goals for chronic bronchitis (the classic description defines Chronic Bronchitis as chronic cough and sputum production for at least 3 months per year for two consecutive years, in the absence of other conditions that can explain these symptoms) include the following:

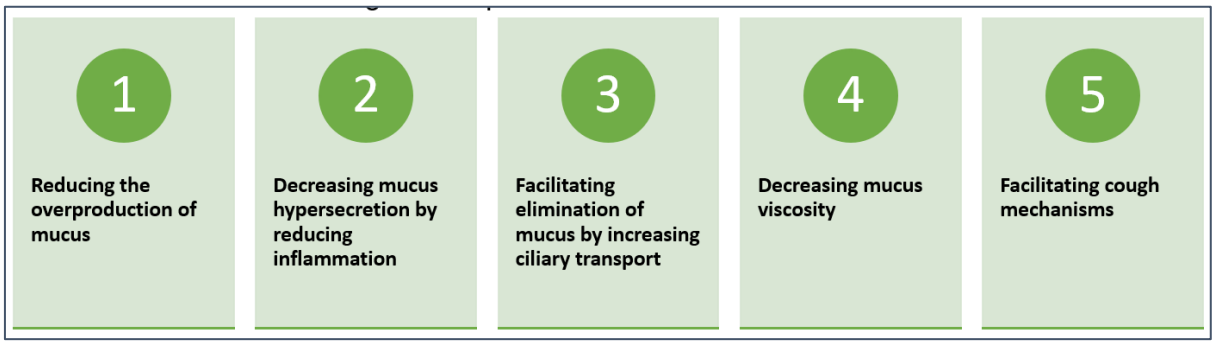

Figure 3: Treatment goals for patients with chronic bronchitis

The British Thoracic Society Guideline for Bronchiectasis in Adults[4]

The BTS Guideline five-step plan for bronchiectasis treatment

STEP 1: All bronchiectasis patients should:

Have a self management plan

Be taught airway clearance techniques

Have exacerbations treated with a course of antibiotics

Be encouraged to have an annual influenza vaccination

Have other illnesses treated if causing bronchiectasis

STEP 2: If a patient is having more than two exacerbations per year they Should have their respiratory physiotherapy checked

May be recommended a treatment to help clear secretions through a nebuliser

May be given muco active drugs (as tablets taken by mouth)

STEP 3: Patients who continue to have more than two exacerbations per year after Step 2 should be offered:

Long term antibiotics; these can be inhaled or swallowed (given orally).

If the type of bacterial infection is known, long term antibiotics that target these bacteria can be used rr long term macrolides.

If there is no bacterial infection, or the type of infection is unknown, long term macrolide treatment should be recommended.

STEP 4: Patients who continue to have more than two exacerbations per year after long term antibiotic treatment

The BTS Guideline recommends that long term macrolides and a long term antibiotic are given together

The long term antibiotic should be inhaled

STEP 5: Patients who have more than four exacerbations per year after Steps 1 - 4:

Should be given an intravenous antibiotic

In the seven studies reviewed (n=146 patients), OPEP therapy was associated with improvements in sputum expectoration and quality of life measures compared with no treatment.

The authors suggested a greater patient preference for OPEP compared with ACBT with or without Gravity Assisted Positioning (GAP).[4]

The guideline also outlines how often should patients carry out airway clearance techniques?

Good practice points

- The frequency and duration of the airway clearance technique should be tailored to the individual and may alter during periods of exacerbation.
- Advise individuals to perform their airway clearance technique for a minimum of 10 minutes (up to a maximum of 30 minutes). After this time they should continue until two clear huffs or coughs are completed, or until the patient is starting to become fatigued.

The British Thoracic Society Quality Standard for Clinically Significant Bronchiectasis in Adults 2022 [5]

The BTS Guideline for Bronchiectasis in Adults 2019 is the main reference for all six quality statements. There is no specific order of priority associated with the list of quality statements. BTS Quality Standards are intended for healthcare professionals to allow decisions to be made about care based on the latest evidence and best practice.

LIST OF QUALITY STATEMENTS

1. People with bronchiectasis should be investigated for treatable causes of bronchiectasis.
2. People with bronchiectasis should be offered a review by a specialist respiratory physiotherapist or qualified healthcare professional.
3. People with bronchiectasis should have an individualised written self-management plan.
4. Patients with bronchiectasis and three or more exacerbations per year should be considered for long-term antibiotic treatment.
5. Services for people with bronchiectasis should include provision of home nebulised prophylactic antibiotics and home intravenous antibiotic therapy for suitable patients, supervised by a respiratory specialist.
6. All patients with bronchiectasis should receive at least an annual review of their condition when clinically stable.

Figure 4: List of Quality Statements

Of particular importance is Quality statement 2, with some content highlighted in Figure 5 and 6.

Quality statement 2
People with bronchiectasis should be offered a review by a specialist respiratory physiotherapist or qualified healthcare professional

Description of what the quality statement means for each audience

► **Service providers**: ensure systems are in place to allow people with bronchiectasis to see a specialist respiratory physiotherapist or qualified healthcare professional at initial diagnosis and access to review for patients who are deteriorating.

► **Healthcare professionals**: ensure that all people with a diagnosis of bronchiectasis are referred to a specialist respiratory physiotherapist or qualified healthcare professional to be taught appropriate airway clearance techniques, which may include adjuncts, and advised of the frequency and duration with which these should be carried out.

► **Commissioners**: ensure that access to specialist respiratory physiotherapy services or qualified healthcare professional are available including the use of airways clearance adjuncts and pulmonary rehabilitation.

► **People with a diagnosis of bronchiectasis**: to be taught appropriate airway clearance techniques, which may include adjuncts, and advised of the frequency and duration with which these should be carried out

Figure 5: The British Thoracic Society Quality Standard for Clinically Significant Bronchiectasis in Adults 2022

Quality statement 2
People with bronchiectasis should be offered a review by a specialist respiratory physiotherapist or qualified healthcare professional

Rationale

► **People with bronchiectasis should be reviewed by a specialist respiratory physiotherapist (band 6 and above) or qualified healthcare professional to optimise airway clearance techniques. Refresher courses may also be of benefit, to ensure techniques are optimised.**

► **Regular airway clearance is regarded as a key component in the management of bronchiectasis because it may improve symptoms and reduce exacerbation frequency**. In patients with more advanced disease, a modified airway clearance regimen may be beneficial. This may include an alternative airway clearance technique or increased frequency and/or duration of current technique.

► **Patients who are deteriorating should be offered a review to ensure airway clearance is optimised and for consideration of additional techniques or adjuncts to therapy.**

► **The BTS guidelines as a good practice point recommend considering a trial of mucoactive treatment in people with bronchiectasis who have difficulty in sputum expectoration**

Figure 6:The British Thoracic Society Quality Standard for Clinically Significant Bronchiectasis in Adults 2022

The European Respiratory Society Guideline for the Management of Adult Bronchiectasis[6]

ERS recommends instrumental techniques as a form of chest physiotherapy for mucus problems

Treatment principles for mucociliary clearance include preventing:

- Mucus stasis and associated mucus plugging
- Airflow obstruction
- Progressive lung damage

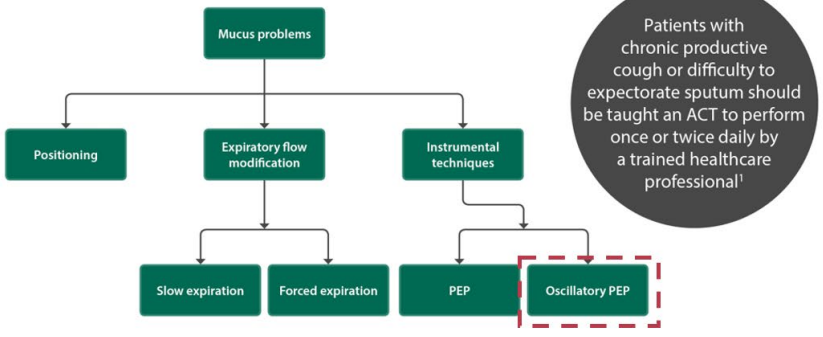

Figure 7: The European Respiratory Society Guideline for the Management of Adult Bronchiectasis

*Aerobika** OPEP in COPD

1. A Real-World Study of 30-Day Exacerbation Outcomes in Chronic Obstructive Pulmonary Disease (COPD) Patients Managed with *Aerobika** OPEP [7]

Study Objectives

- To measure the rate of early (30-day) moderate-to-severe exacerbations in COPD patients treated with the ***Aerobika**** OPEP device, versus a match control group in a real-world setting.

Methods

- Real-world, retrospective study that utilised data from IQVIA's hospital database (consists of over 650 US hospitals, 7 million inpatient stays and 60 million outpatients visits each year)
- COPD patients treated with ***Aerobika**** OPEP were propensity score (PS) matched to COPD patients who did not use any PEP devices.
    - Propensity score matching mimics the selection process of a randomized control trial.
    - Patients were matched on age, gender, Charlson Comorbidity Index (CCI), medication history (i.e., ICS), history of exacerbations in the year prior to the study.
    - A total of 405 ***Aerobika**** OPEP patients were matched to 405 controls.
    - Patients were excluded from both groups if they had evidence of OPEP or PEP used before the index date (the first date the ***Aerobika**** device was provided after a hospital visit or admission)
    - A moderate-to-severe exacerbation was defined as a hospitalisation, or an emergency department (ED) visit with a diagnosis for chronic bronchitis or COPD.
    - Exacerbations were compared between cohorts at 30 days.

Results

- At 30 days, 18.5% of subjects using the ***Aerobika**** OPEP vs. 25.7% of controls had a moderate-to-severe exacerbation (p=0.014); that is to say that patients experiencing a moderate-to-severe exacerbation at 30 days was reduced by 28% in the ***Aerobika**** group.

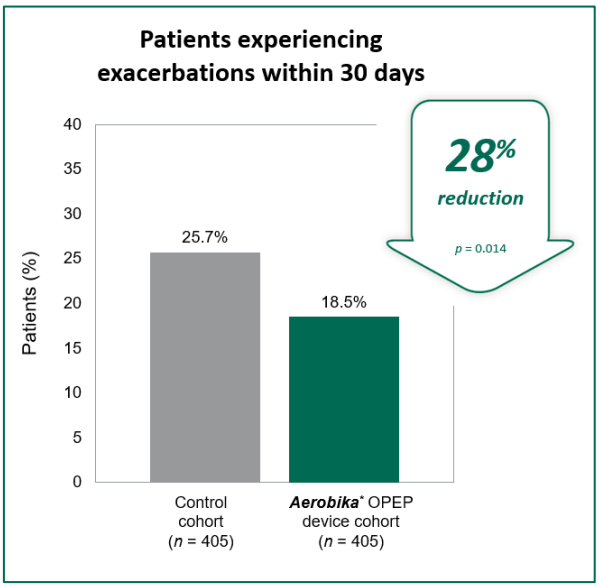

Figure 8: OPEP Therapy Significantly Reduced COPD Exacerbations

- Because this study utilises hospital claims data (retrospective), the duration and frequency of use of the device is unknown. No listed complications were reported.

Conclusions

- Study findings suggest that using the ***Aerobika**** OPEP as part of a treatment regimen may help reduce ED visits, hospital readmissions and related costs in COPD patients who have a history of exacerbations

2. Oscillating Positive Expiratory Pressure in Chronic Obstructive Pulmonary Disease[1]

Study Objectives

- The objective of this randomized crossover study was to evaluate daily OPEP use in COPD patients, self-identified as sputum or non-sputum-producers. The hypothesis was that in chronic sputum-producers with COPD, OPEP use would improve sputum movement out of the airways resulting in clinically relevant symptom improvements. Investigators also looked at whether functional imaging measurements (ventilation) would be related to improvements in symptoms, thereby generating evidence to support the use of OPEP in certain COPD patients.

Methods

- 14 COPD patients, self-identified as sputum-producers and 13 COPD-non-sputum-producers completed the study.
- 69 (± 8) years old; 14 male, 13 female
- Of the 14 self-identified sputum producers, 8 had CT evidence of bronchiectasis.
- Crossover study
  - Aerobika* OPEP device for 3 weeks; treatments 4x daily
  - All participants were trained by a pulmonary function technologist to use the device 4x daily with each session consisting of 10-20 blows into the device, followed by 2-3 huff coughs.
  - No device (3 weeks)
  - Participants completed baseline, crossover and study-end pulmonary function tests, St. George's Respiratory Questionnaire (SGRQ), Patient Evaluation Questionnaire (PEQ), Six-Minute Walk Test and (3)He magnetic resonance imaging (MRI) for the measurement of ventilation abnormalities using the ventilation defect percent (VDP).
  - Smoking habits were not modified during the study.

Results

- Post-OPEP, an improvement in lung ventilation, lung function and quality of life was observed.
- There were significant post-OPEP improvements for sputum-producers (only) for
  - FVC ($p = 0.01$),
  - 6MWD ($p = 0.04$),
  - SGRQ total score ($p = 0.01$) as well as,
  - PEQ-patient-global-assessment ($p = 0.02$)
- The mean improvement in FVC for sputum-producing COPD patients was 200 ml. This was a statistically significant improvement.

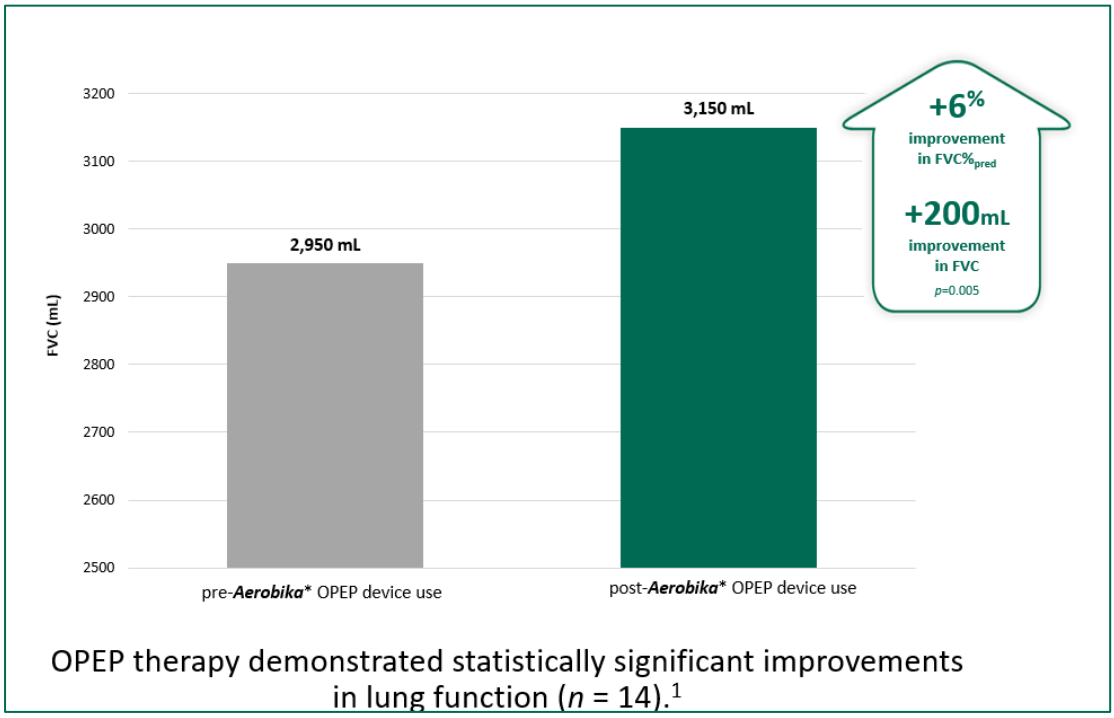

Figure 9: OPEP Therapy Significantly Improved Lung Function in COPD Patients

- Post-OPEP, the PEQ-ease-of-bringing-up-sputum was improved for sputum-producers (p = 0.005) and non-sputum-producers (p = 0.04)
- The magnitude of which was greater for sputum-producers (p = 0.03)
- The post-OPEP change in PEQ-ease-of-brining-up-sputum (r = 0.65, p = 0.0004) and FEV1 (r = -0.50, p = 0.009) was related to the post-OPEP change in (3)He MRI VDP (ventilation – refer to ***Figure 1***)

Conclusion

- In COPD patients with chronic sputum production, PEQ and Quality of Life (SGRQ) scores, FVC and 6MWD improved post-OPEP. Additionally, FEV1 and PEQ-ease-bringing-up-sputum improvements were related to improved ventilation providing mechanistic evidence to support OPEP use in COPD.

3. Quality of Life Responder Rate Analysis Following Use of an Oscillating Positive Expiratory Pressure Device for Chronic Obstructive Pulmonary Disease: SGRQ v CAT Assessments[8]

Study Objectives

- This study compares the responder rates from two separate studies using the same device; one with the St. George's Respiratory Questionnaire (SGRQ)[1] and the other with the COPD Assessment Test (CAT).[9]

Method

- Study 1, a randomized cross-over study in 14 sputum-producing COPD patients for 3-4 weeks, used the SGRQ.
- Study 2, a clinical assessment of 37 COPD patients (26 chronic bronchitis (CB) patients; 11 patients who had a diagnosis of emphysema were excluded from the analysis) over an 8-week period, used the CAT.

- Taking clinically significant measures of improvement of greater than 4 and at least 2 (for the SGRQ and CAT respectively), responder rates were calculated for COPD patients with CB.

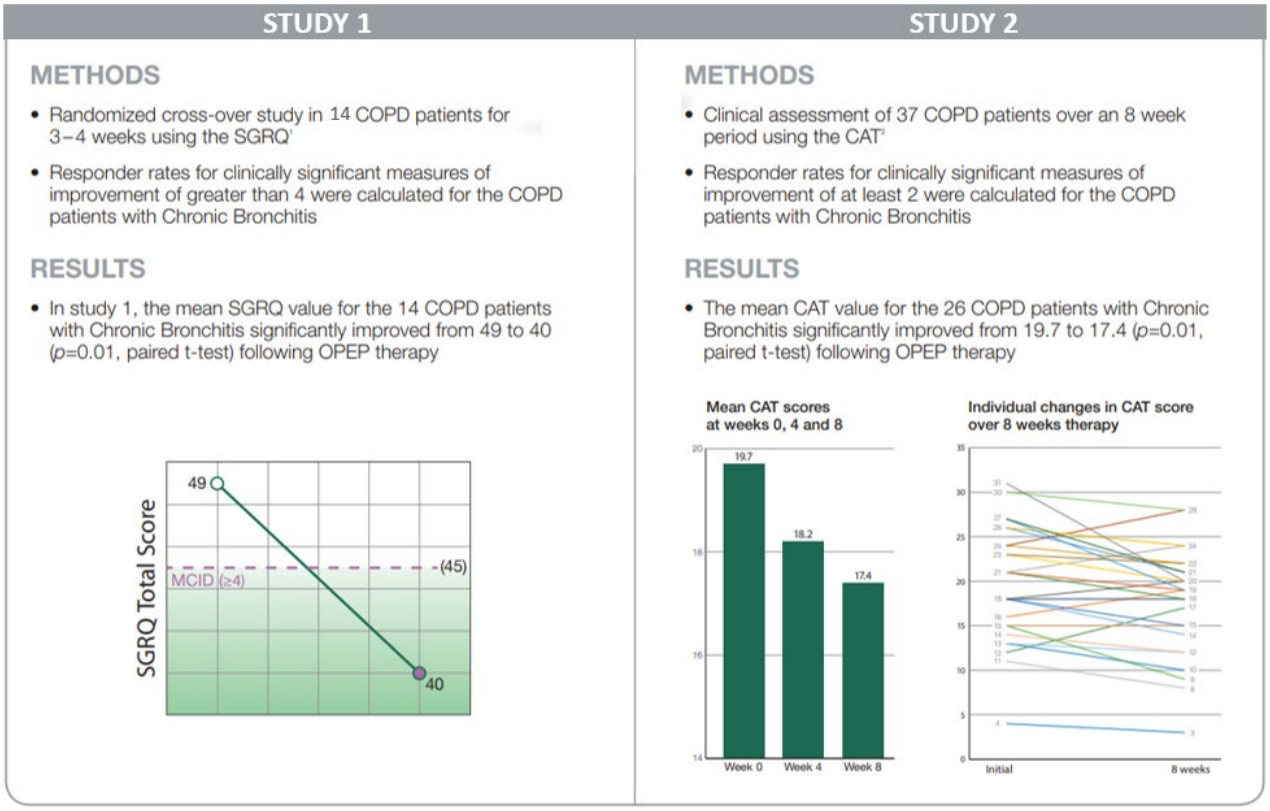

Figure 10: OPEP Therapy Improved Quality of Life in COPD Patients

Results

- Responder rates showed significantly improved quality of life as measured by both the SGRQ and CAT.

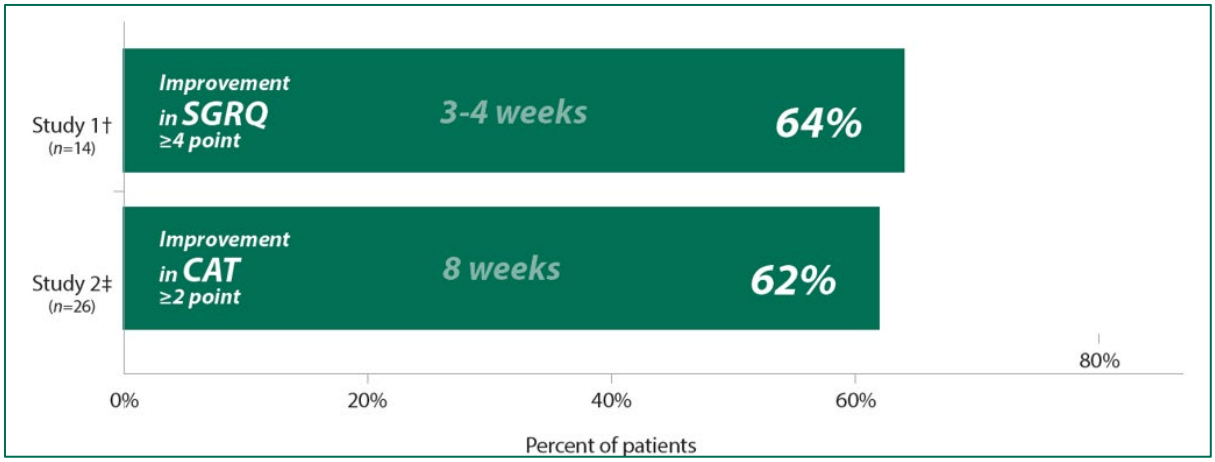

Figure 11: OPEP Therapy Improved Quality of Life in COPD Patients

† Randomized, cross-over study evaluating the efficacy of the ***Aerobika**** OPEP device after 3-4 weeks of treatment in patients with COPD and chronic bronchitis.[1]

‡ Clinical assessment of patients with COPD and chronic bronchitis over 8 weeks of treatment with the ***Aerobika**** OPEP device.[9]

Aerobika * OPEP in Bronchiectasis

1. Effectiveness of the Use of an Oscillating Positive Expiratory Pressure Device in Bronchiectasis with Frequent Exacerbations: a Single-Arm Pilot Study[10]

Study Objectives

- Impaired airway clearance in patients with non-CF bronchiectasis (BE) causes frequency bacterial infection, chronic inflammation, and progressive tissue damage. This study aimed to evaluated whether an OPEP device (***Aerobika****) could allow effective sputum expectoration and prevention of acute exacerbations (AE) in patients with BE who had frequent AE.

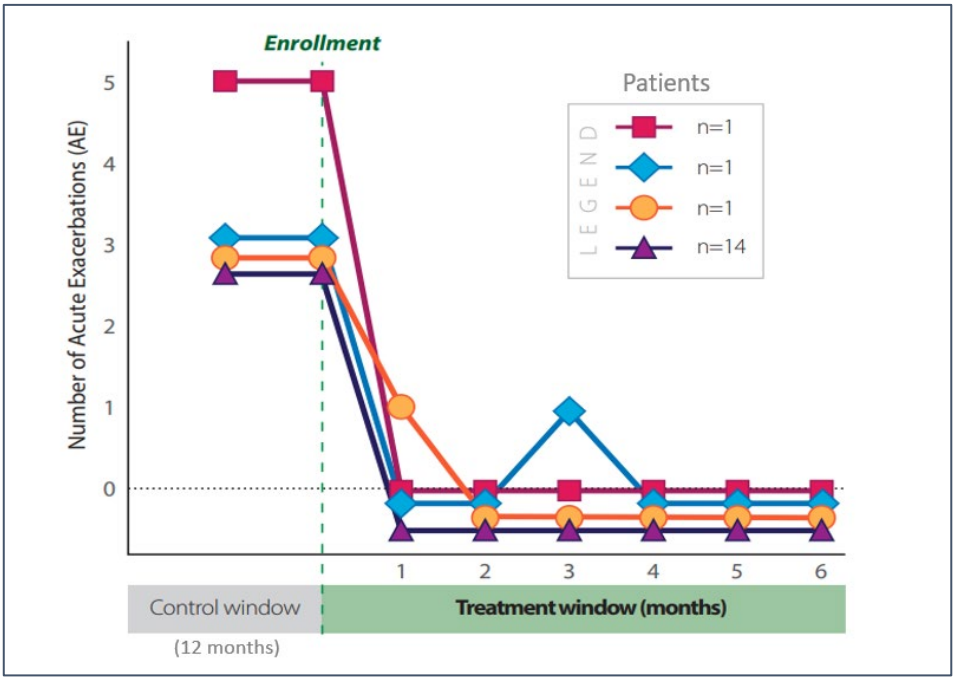

Figure 12: OPEP Therapy Significantly Reduced Bronchiectasis Exacerbations

Methods

- This open-label, single-arm, prospective study was conducted on 17 patients who experienced three or more acute exacerbations per year.
  - Patients were identified from the Korean Multicenter Bronchiectasis Audit and Research Collaboration (KMBARC) registry.
  - An acute exacerbation was defined as worsening of three or more major symptoms lasting >= 48 hours, which results in a change in treatment. The main symptoms included coughing, change in sputum volume/viscosity, sputum suppuration, dyspnea, exercise ability, fatigue, malaise, and hemoptysis.
  - Patients were performing prior drainage techniques such as ACBT and/or AD (patients instructed to continue these methods throughout treatment phase)
  - Median patient bronchiectasis severity index (BSI) score was 9, suggesting that these are severe bronchiectasis patients.

- Evaluated the prevention of acute exacerbations, subjective symptom improvement, and sputum amount change during the use of the Aerobika* OPEP device twice daily for 6 months.
    - Each session was defined as 10-20 blows into the device followed by 2-3 huff coughs. Patients were instructed to repeat the session for 10-20 minutes.
- At baseline and the last visit, results of the patient questionnaire (Bronchiectasis health questionnaire – Bronchiectasis QoL questionnaire) were obtained.
- Patients received monthly phone calls for obtaining information regarding acute exacerbations and adverse events.

Results

- Of all enrolled patients, only two acute exacerbations occurred during the study period, indicating a significant decrease compared with the number of acute exacerbations before the device use ($p<0.001$).
- Bronchiectasis Health Questionnaire (BHQ) score changed from 58.6 to 66.6 ($p<0.001$)
- No major adverse event related to use of the OPEP device.

Conclusions

- This is the first study to investigate AE prevention via use of an OPEP device in patients with bronchiectasis.
- Daily physiotherapy with OPEP device in patients with bronchiectasis who have frequent AE may facilitate symptomatic improvement and prevention of AE without serious adverse events.

In a separate study[11] the impact of exacerbations highlighted the following:

- Patients with frequently exacerbating disease have a worse quality of life.
- Mortality increases with increasing exacerbation frequency.
- The study's authors concluded that the frequent exacerbator is a valid clinical phenotype with more frequent hospitalizations, impaired quality of life and increased 5-year mortality.

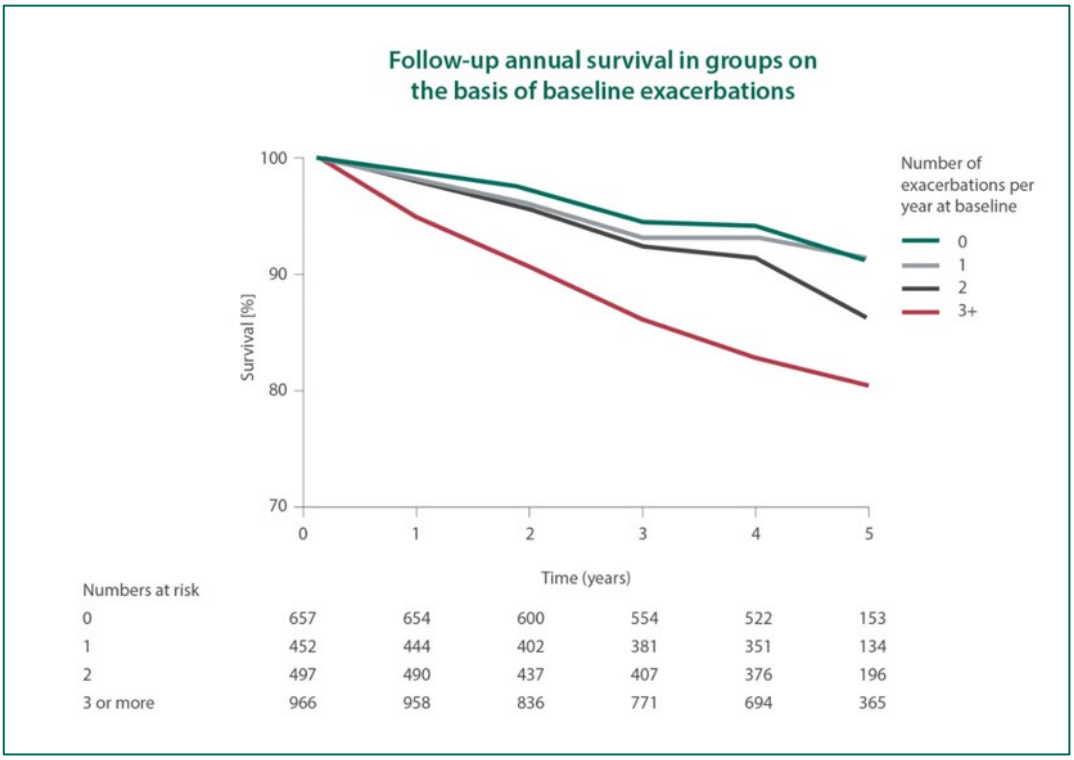

Figure 13: Impact of Exacerbations on Patients

2. Failure of *M. avium* to adhere to interior surfaces of OPEP and Nebulizer device.[12]

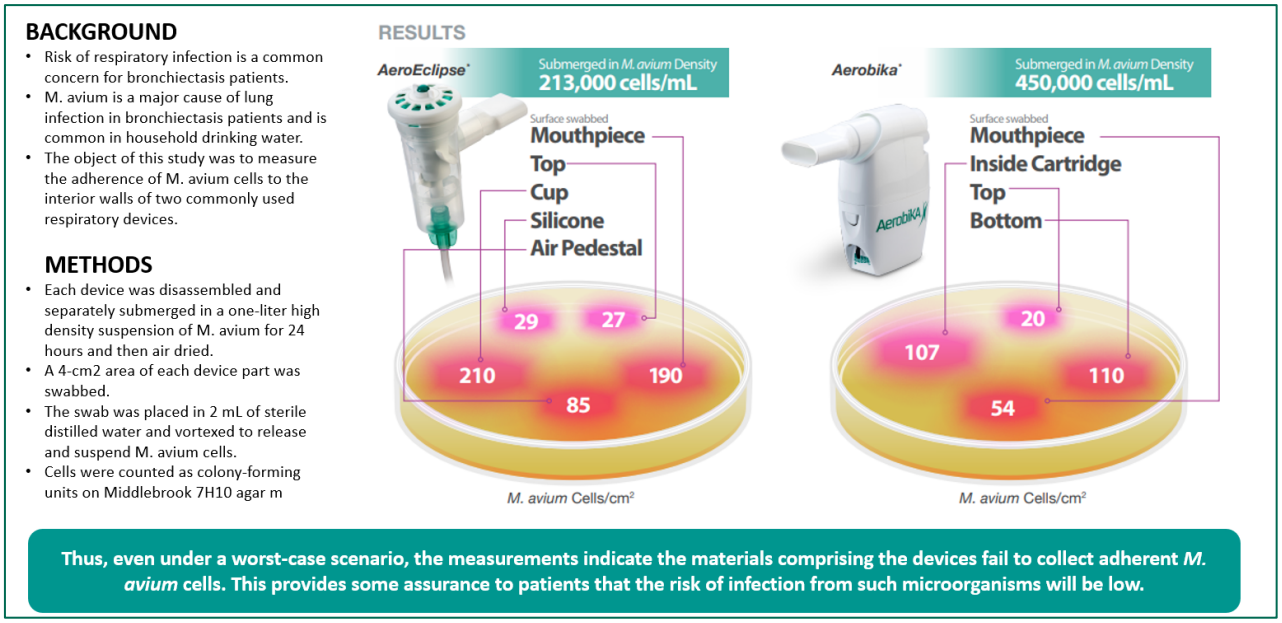

Figure 14: Failure of M. avium to adhere to interior surfaces of OPEP and Nebulizer device

The test was designed to provide a worst-case scenario with a very high-density suspension of *M. Avium* cells and a long 24-hr period to allow for adherence. Compared with copper, stainless steel, galvanized steel, and PVC surfaces the number of adherent *M. Avium* cells on the surfaces of ***AeroEclipse® XL BAN®*** Nebuliser and ***Aerobika**** OPEP device is minimal.

This provides some reassurance to patients that the risk of infection from such microorganisms will be low in the event that cleaning is not performed robustly.[11]

3. Non-Cystic Fibrosis Bronchiectasis: Regional Abnormalities and Response to Airway Clearance Therapy Using Pulmonary Functional Magnetic Resonance Imaging[13]

Study Objectives

- Evidence-based treatment and management for patients with bronchiectasis remain challenging.
- The overall goal of treatment is to improve quality of life by reducing cough, sputum volume, sputum purulence, and the number of chest infections.
- Our objective was to evaluate the ability of magnetic resonance imaging (MRI) to detect regional ventilation impairment and response to airway clearance therapy (ACT) in patients with non-cystic fibrosis (CF) bronchiectasis, providing a new way to objectively and regionally evaluate response to therapy.

Methods

- 15 participants with non-CF bronchiectasis and 15 age-matched healthy volunteers (no history or diagnosis of any chronic or current acute respiratory illness) underwent spirometry, plethysmography, computed tomography (CT), and hyperpolarized 3He MRI.
- Bronchiectasis patients also completed a Six Minute Walk Test, the St. George's Respiratory questionnaire, and Patient Evaluation Questionnaire (PEQ), and returned for a follow-up visit after 3 weeks of 4x daily oscillating positive expiratory pressure use (***Aerobika**** OPEP device).
- CT evidence of bronchiectasis was qualitatively reported by lobe, and MRI ventilation defect percent (VDP) was measured for the entire lung and individual lobes.

Results

- CT evidence of bronchiectasis and abnormal VDP (14 ± 7%) was observed for all bronchiectasis patients and no healthy volunteers.
- There was CT evidence of bronchiectasis in all lobes for 3 patients and in 3 ± 1 lobes (range = 1–4) for 12 patients.
- VDP in lobes with CT evidence of bronchiectasis (19 ± 12%) was significantly higher than in lobes without CT evidence of bronchiectasis (8 ± 5%, P = .001).
- For patients, VDP in lung lobes with (P < .0001) and without CT evidence of bronchiectasis (P = .006) was higher than in healthy volunteers (3 ± 1%).
- For all patients, mean PEQ-ease-bringing-up-sputum (P = .048) and PEQ-patient-global-assessment (P = .01) were significantly improved post-oscillatory positive expiratory pressure.
- An improvement in regional VDP greater than the minimum clinical important difference was observed for 8 of the 14 patients evaluated.

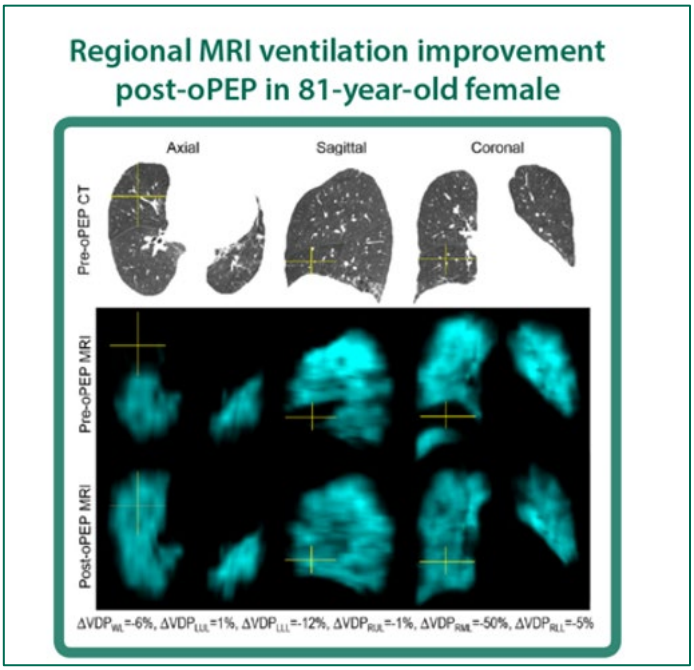

Figure 15: OPEP Therapy Showed Improvements in Ventilation in Bronchiectasis Patients

Conclusions

- There was CT and MRI evidence of structure-function abnormalities in patients with bronchiectasis; in approximately half, there was evidence of ventilation improvements after OPEP.

*Aerobika** OPEP in Cystic Fibrosis

1. Evaluating the Use of an Oscillating Positive Expiratory Pressure Device as Part of Airway Clearance in Pediatric Patients with Cystic Fibrosis[14]

Study Objectives

- It is necessary for children with Cystic Fibrosis (CF) to undertake regular Airway Clearance Techniques (ACT) due to increased secretions, inflammation and potential deficits in lung function.
- Maintaining adherence to ACTs is a challenge for all people with CF.
- In order to improve adherence and quality of care, we introduced and evaluated the use of an Oscillatory Positive Expiratory Pressure (OPEP) device in addition to current ACT techniques.

Methods

- 16 patients were recruited from a paediatric CF clinic in North Wales to evaluate the ***Aerobika**** OPEP device.
  - Age: 6-16 years: 10 male, 6 female
  - 3-month period
- Patients were advised on implementing the use of the ***Aerobika**** device for 15 breaths over 9 minutes in conjunction with their own individual ACT which included Active Cycle of Breathing (ACBT, 3 cycles), Forced Expiratory Techniques (FET) and in some cases Autogenic Drainage (AD).

- Frequency of use was 3x daily and duration of use was 9 minutes.

- A pressure manometer was provided for some patients, depending on age and capacity prior to the trial (imaged below)
  - The manometer features a visual feedback that measures exhalation pressure, guiding patient technique to help achieve maximum treatment effectiveness.
- Telephone follow-up at 1 month post initiation was undertaken and a 5-point questionnaire including feedback from both patient/parent and physiotherapist at 3 months.

Results

- Evaluations were completed by 10 patients and 6 parents.

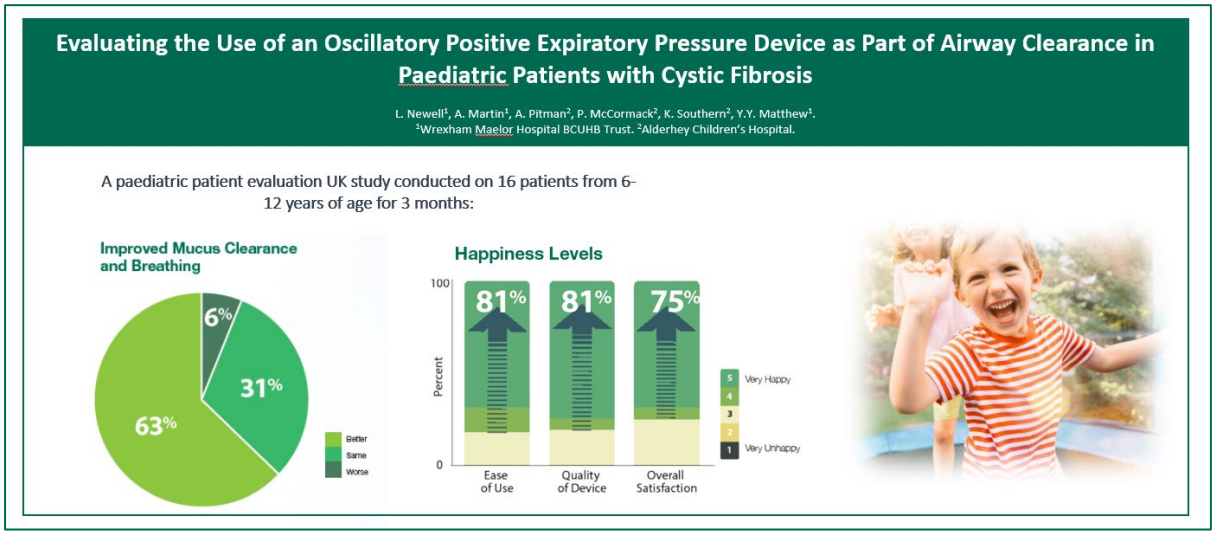

Figure 16: Symptom Improvement and Patient Satisfaction in CF

- All respondents (16) reported that they would continue using the device.
- 94% of patients/parents indicated that mucus clearance and breathing either remained the same or improved.
- 81% found the device easy to use, and 81% were happy with the quality of the device.

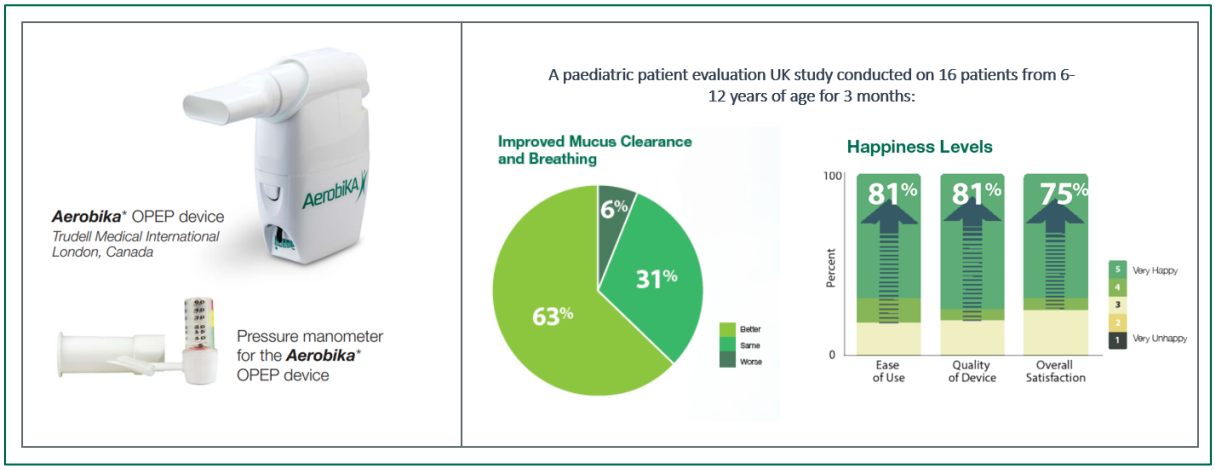

Figure 17: Symptom Improvement and Patient Satisfaction in CF

Conclusions

- All 16 participating patients benefited from the use of the ***Aerobika**** device to supplement their individual evidence-based regime of Airway Clearance Techniques (ACT).
- The ***Aerobika**** OPEP device was found to be a useful device for supplementing ACT for this Paediatric patient group with CF.
- Dependent on age, it was particularly useful to use the manometer device to regulate and modify changes to patient treatments dependent on their symptoms and disease progression.
- Both patients and parents reported improved adherence and frequency of treatment

2. Effect of Aerobika*, an Oscillating Positive Expiratory Pressure Device, on Lung Function in Pediatric CF Patients: A Longitudinal Analysis[15]

Background

- Airway clearance therapy (ACT) is a cornerstone of cystic fibrosis (CF) care.
- Multiple ACT modalities are available, but little evidence exists to support the use of one over another.

Objective

- Examine the effect of ***Aerobika****, an Oscillatory Positive Expiratory Pressure device (OPEP), on lung function over time in a pediatric CF clinic.

Methods

- Retrospective longitudinal study of lung function in pediatric patients at a single CF center, stratified by ***Aerobika**** use.
- Measures: Lung function – ppFEV1.
- Exposure:
    - ***Aerobika****, use alone or concurrently with a high frequency chest wall oscillating (HFCWO) vest, vs, no ***Aerobika****.
- Study period: 2016-2021 and study population: N=146.
- Statistical Analysis: Longitudinal analysis used mixed modeling, which contains both fixed effects and random effects. We allow for a random intercept and slope; stata 15.

Results

- ***Aerobika**** use is associated with 7.2 higher ppFEV1 (p=0.009).

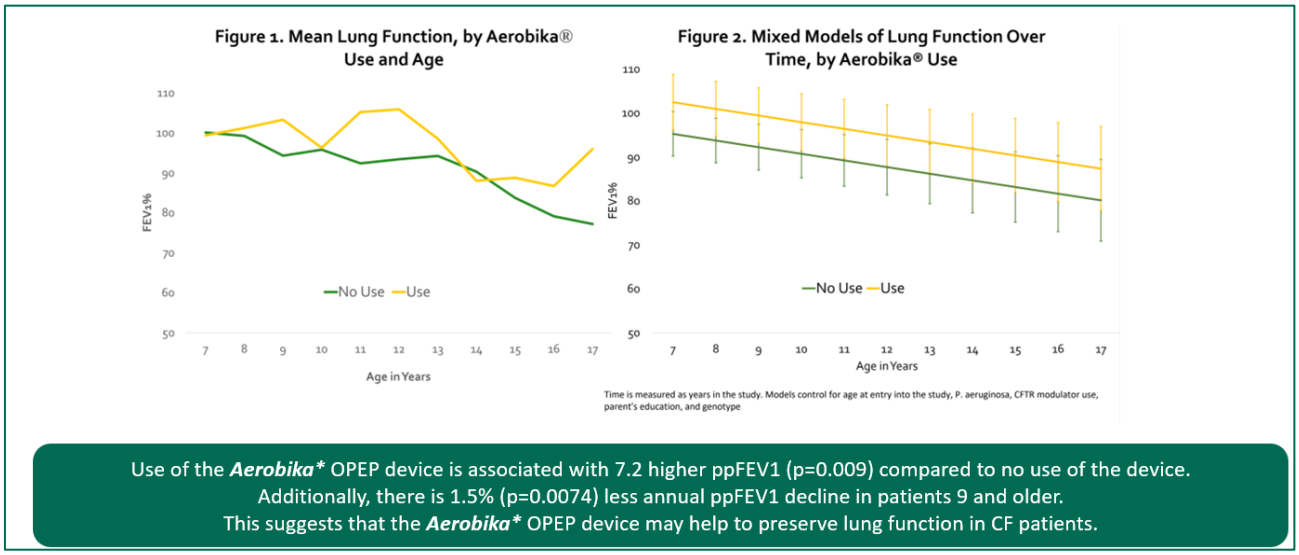

Figure 18: OPEP Therapy May Help Preserve Lung Function in CF

Conclusion

- ***Aerobika****, used alone or with a HFCWO vest, may help preserve lung function.
- Effect size may be larger for older patients.
    - 1.5% (p=0.074) less annual ppFEV1 decline in patients 9 and older.
- Implications: Evaluate clinical efficacy in a randomized controlled trial. Identify most appropriate age for introducing the device. Take steps to address inequities in use.

Benefits of the *Aerobika** OPEP Device - A Review of Clinical Evidence

	PUBLICATION	KEY EVIDENCE SUMMARY
		COPD
1	***Therapeutic Efficacy of Oscillating Positive Expiratory Pressure Therapy in Stable Chronic Obstructive Pulmonary Disease***[16]	**Background:** Chronic obstructive pulmonary disease (COPD) is characterised by persistent airflow limitation that is usually progressive and associated with an enhanced chronic inflammatory response in the airway and the lung to noxious particles or gases. Sputum production is a cardinal feature in COPD. Airway clearance techniques have been the mainstay of management. Oscillating positive expiratory pressure (OPEP) devices are handheld devices that provide a combination of positive expiratory pressure (PEP) with high frequency oscillations which involve exhaling against a resistance that is fluctuating. It encourages airflow within secretions, whereas oscillations induce vibrations within airway wall to displace secretions into airway lumen and help in expectoration. **Methods:** A randomised control trial was conducted at the department of pulmonary medicine, Government Medical College & Hospital, Chandigarh, in which 50 patients with stable COPD were enrolled for one-and- half years. After taking proper history, they were subjected to spirometry, six- minute walk test, and were asked to fill the St. George's Respiratory Questionnaire (SGRQ) and COPD Assessment Test (CAT). These patients were randomized into group A (intervention group) and group B (control group), where group A was prescribed ***Aerobika**** OPEP device for daily use for a period of three months. After three months of use of device, the patients were again subjected to assessment parameters and inquired about any exacerbation within the three-month period. **Results:** At the end of three months were compared with baseline results. The median change in FEV1, FVC, 6MWD from baseline in group A was significantly more as compared to group B (FEV1: $P < 0.001$; FVC: $P < 0.001$; 6MWD: $P = 0.08$), whereas SGRQ score showed a significant improvement in both the intervention and control groups ($P < 0.001$) and CAT score showed significant improvement in comparison to the control group ($P < 0.001$). The median change in 6MWD and CAT from baseline in group A was significantly more as compared to group B (SGRQ: $P < 0.001$; CAT: $P < 0.001$), whereas it was not significant in case of SGRQ ($P = 0.233$). There was no significant difference in the incidence of exacerbation in the two groups ($P = 0.19$). The device did not help in controlling the rate of exacerbation in the present study at three months. **Conclusion:** Stable COPD patients who were given OPEP therapy as an adjunct to the standard drug therapy showed improvement in the spirometry parameters, exercise capacity and symptom burden in comparison to the drug only group.
2	***Retrospective Cohort Study Comparing an Oscillating Positive Expiratory Pressure (OPEP) Device vs***	**Rationale:** For patients with COPD, acute exacerbations are the most common reason for hospital admissions, with approximately 1 in 5 patients requiring re-hospitalisation within 30 days of discharge. The ***Aerobika**** OPEP device has previously been shown to significantly improve outcomes such as ease in bringing up sputum, forced vital capacity, quality of life, and exacerbations, when added to standard of care. This retrospective cohort study described real-world outcomes among patients with COPD or chronic bronchitis, comparing the Aerobika* OPEP device to the similar, but more basic PEP device, which

	Positive Expiratory Pressure (PEP) Devices in Patients with Chronic Obstructive Pulmonary Disease (COPD) or Chronic Bronchitis on Hospital Readmissions at 30 Days[17]	does not generate pressure pulses. **Methods:** IQVIA's Charge Detail Master (CDM) hospital claims database linked to medical (Dx) and prescription claims (LRx) data were used to identify patients receiving the Aerobika* (Trudell Medical International) OPEP device or any PEP device between September 2013 and November 2018; the index date was the first CDM record with an OPEP/PEP device. Patients were required to be ≥18 years of age and have ≥1 hospital and LRx/Dx records within 12 months before and after index, ≥1 COPD/chronic bronchitis diagnosis during the index visit and no asthma diagnosis before index or post-operative device use within 30 days before index. Patients receiving the Aerobika* OPEP device were propensity score (PS) matched to patients receiving a PEP device based on demographics and baseline comorbidities, history of exacerbations and drug therapy. The proportion of patients experiencing a COPD/chronic bronchitis related readmission within 30 days of the index visit was evaluated. **Results:** After 1:1 PS matching, 588 patients receiving Aerobika* and 588 receiving PEP were compared. Baseline characteristics were well-balanced. Patients using Aerobika* OPEP had a 31% reduction in COPD/chronic bronchitis related readmission within 30 days of the index hospitalization compared to those patients with a PEP device (12.4% vs. 17.9%; p=0.006). **Conclusions:** Results from this study demonstrate a reduction in COPD/chronic bronchitis related readmissions within 30 days of Aerobika* OPEP device therapy initiation compared to PEP therapy. This further supports the use of the Aerobika* OPEP device as an add-on to usual care to manage COPD/chronic bronchitis patients post-exacerbation and provides some evidence as to the additional benefit of pressure oscillations over standard PEP.
3	***Impact of Oscillating Positive Expiratory Pressure Device Use on Post-Discharge Hospitalizations : A Retrospective Cohort Study Comparing Patients with COPD or Chronic Bronchitis Using the Aerobika® and Acapella® Devices***[18]	**Background:** Managing and preventing disease exacerbations are key goals of COPD care. Oscillating positive expiratory pressure (OPEP) devices have been shown to improve clinical outcomes when added to COPD standard of care. This retrospective database study compared real-world resource use and disease exacerbation among patients with COPD or chronic bronchitis prescribed either of two commonly used OPEP devices. **Patients and methods:** Patients using the ***Aerobika****** (Trudell Medical International, London, ON, Canada) or Acapella® (Smiths Medical, Wampsville, New York, USA) OPEP device for COPD or chronic bronchitis were identified from hospital claims linked to medical and prescription claims between September 2013 and April 2018; the index date was the first hospital visit with an OPEP device. Severe disease exacerbation, defined as an inpatient visit with a COPD or chronic bronchitis diagnosis, and all-cause healthcare resource utilisation over 30 days and 12 months post-discharge were compared in propensity score (PS)-matched ***Aerobika**** device and Acapella device users. **Results:** In total, 619 Aerobika device and 1857 Acapella device users remained after PS matching. After discharge from the index visit, Aerobika device users were less likely to have ≥1 severe exacerbation within 30 days (12.0% vs 17.4%, p=0.01) and/or 12 months(39.6% vs 45.3%, p=0.01) and had fewer 12-month severe exacerbations (mean, 0.7 vs 0.9 per patient per year, p=0.01), with significantly longer time to first severe exacerbation than Acapella users (log-rank p=0.01). Aerobika device users were also less likely to have ≥1 all cause inpatient visit within 30 days (13.9% vs 20.3%,

		p<0.001) and 12 months (44.9% vs 51.8%, p=0.003) than Acapella users. **Conclusion:** Patients receiving the Aerobika OPEP device, compared to the Acapella device, had lower rates of subsequent severe disease exacerbation and all-cause inpatient admission. This suggests that ***Aerobika**** OPEP device may be a beneficial add-on to usual care and that OPEP devices may vary in clinical effectiveness.
4	***Real-World Study of 30-Day Exacerbation Outcomes in Chronic Obstructive Pulmonary Disease (COPD) Patients Managed with Aerobika* OPEP*** [7]	**Introduction:** Oscillating positive expiratory pressure (OPEP) devices may reduce chronic symptoms in patients with obstructive pulmonary disease (COPD); however, no real-world studies have been performed to evaluate the benefits of these devices. The objective of this study was to measure the rate of early (30-day) moderate-to-severe exacerbations and related costs in COPD patients treated with Aerobika*, an OPEP device, vs. a matched control group in a real-world setting. Methods: The study utilized data from the QuintilesIMS' CDM hospital database. COPD patients treated with Aerobika* OPEP between 9/2013 and 8/2015 were propensity score matched to COPD patients who did not use any positive expiratory pressure device. Severe exacerbation was defined as a hospital admission with a diagnosis for chronic bronchitis or COPD. Moderate-to-severe exacerbation was defined as a hospitalization or an ED visit with a diagnosis for chronic bronchitis or COPD. Exacerbations and costs were compared between cohorts at 30 days. A generalized linear model (GLM) was used to estimate the marginal effect of Aerobika* OPEP on the cost of ED visits and hospitalizations due to COPD exacerbations. Results: A total of 405 Aerobika* OPEP patients were matched to 405 controls. At 30 days, 18.5% of subjects using the Aerobika* OPEP vs. 25.7% of controls had a moderate-to-severe exacerbation (p=0.014); 13.8% of subjects with Aerobika* OPEP vs. 19.0% of controls had a severe exacerbation (p=0.046). The mean per patient cost of moderate-to-severe exacerbations and severe exacerbations in the Aerobika* OPEP group was significantly lower than controls ($2975 vs. $6065; p=0.008, and $2838 vs. $5871; p=0.009, respectively). In the GLM, the per-patient cost of moderate-to-severe exacerbations in the Aerobika* OPEP group was 34% lower (p=0.012) than the control group. Conclusions: Study findings suggest that using Aerobika* OPEP as part of a treatment regimen may help reduce ED visits, hospital re-admissions and related costs in COPD patients who have a history of exacerbations.
5	***A Retrospective Cohort Study Demonstrating the Impact of an OPEP Device on Exacerbation Related Healthcare Costs in COPD Patients with Chronic Bronchitis*** [19]	**Purpose:** In Chronic Obstructive Pulmonary Disease (COPD) patients with Chronic Bronchitis (CB) the ***Aerobika**** Oscillating Positive Expiratory Pressure (OPEP) device has been shown to significantly improve measures such as Ease-bringing-up-sputum, Forced Vital Capacity, Quality of life and 6 Minute Walk Distance. This abstract reports moderate-to-severe exacerbation related healthcare cost data from a real-world study over 6 months among COPD patients with CB. **Background:** COPD exacerbations account for the greatest proportion of the total COPD burden on the healthcare system. In the US, the estimated direct cost is $30 billion and the indirect cost is approximately $20 billion. The US national average 30 day readmission rate for patients hospitalized with a COPD exacerbation is 23%. The US Centres for Medicare and Medicaid Services (CMS) has introduced 30 day readmission reimbursement penalties with the goal of reducing 30 day readmission rates. COPD cases are projected to increase 155% from 2010 to 20304.

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<td>There is a predicted epidemic of COPD hospitalizations over the next 15 years.
<u>Methods:</u> A retrospective cohort study of the CDM hospital claims database was conducted between September 2013 and August 2015. Moderate to severe exacerbations were defined as requiring either a hospital ER visit or hospital admission. Study participants n=810; patients who used the Aerobika* device n=405; propensity score matched controls n=405; Propensity score matches included, amongst others, demographics, history of exacerbations, comorbidities, and drug usage. Inclusion Criteria included CDM record with CB diagnosis [ICD-9 491.xx] from 01/01/2011– 09/30/2015, documented Aerobika* device use, newly initiated, ≥1 CDM record before and after their index date and at least ≥35 years old in the year of index visit. Exclusion Criteria included incomplete demographic data (age, gender), use of Aerobika* device before their index date, and use of PEP or other OPEP devices at any time during the study period.
<u>Results:</u> The mean cost of moderate-to-severe exacerbations per patient was significantly reduced in patients who used the Aerobika* device plus baseline care.
<table>
<tr><th colspan="4">Cost Reduction</th></tr>
<tr><td>Length of Time</td><td>30 Days</td><td>3 Months</td><td>6 Months</td></tr>
<tr><td>Mean Cost (USD)</td><td>-$6,347 (p=0.008)</td><td>-$6,600 (p=0.031)</td><td>-$9,936 (p=0.018)</td></tr>
</table>
The device cost is included in the calculation; the mean cost reductions show significant savings to the healthcare system.

<u>Conclusions:</u> Patients in the Aerobika* device cohort exhibited significantly lower costs throughout the 6 month study period. These findings provide additional evidence that the drug-free Aerobika* device may be an effective addition to a disease management plan for COPD patients with chronic bronchitis and a history of exacerbations.</td>
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<td>6</td>
<td>Review of Quality of Life Outcomes Following Use of an Oscillating Positive Expiratory Pressure Device for Chronic Obstructive Pulmonary Disease: Comparison of Small n Clinically Controlled and Validated</td>
<td><u>Background:</u> Airway clearance therapy can be used to help mobilize and clear excess mucus secretions in the lungs. Excess mucus is a common complaint for Chronic Obstructive Pulmonary Disease (COPD) patients with chronic bronchitis. Contributes to breathlessness, chronic cough and difficulty performing daily tasks resulting in poor quality of life. Effective airway clearance can result in an improved quality of life. We compared the quality of life outcomes for COPD patients following treatment with a new Oscillating Positive Expiratory Pressure (OPEP) device (Aerobika* OPEP, Trudell Medical International, Canada), both in a cross-over clinical study using the validated St. George's Respiratory Questionnaire (SGRQ) and in a much larger non-validated patient survey. <u>Methods:</u> Randomized, 6 week cross-over study of 14 COPD (Chronic Bronchitis) patients.1 Difference in SGRQ scores pre and post OPEP therapy were compared. In a separate evaluation, Aerobika* OPEP devices and associated surveys were supplied to non-phenotyped COPD patients in Ontario, Canada via their healthcare provider. Feedback was received from 461 patients following 1 month's use. <u>Results:</u> Clinical study results: The mean SGRQ Total Score for the 14 COPD patients in the 6 week cross-over study changed from 45 pre-OPEP to 36 post-OPEP. A decrease in</td>
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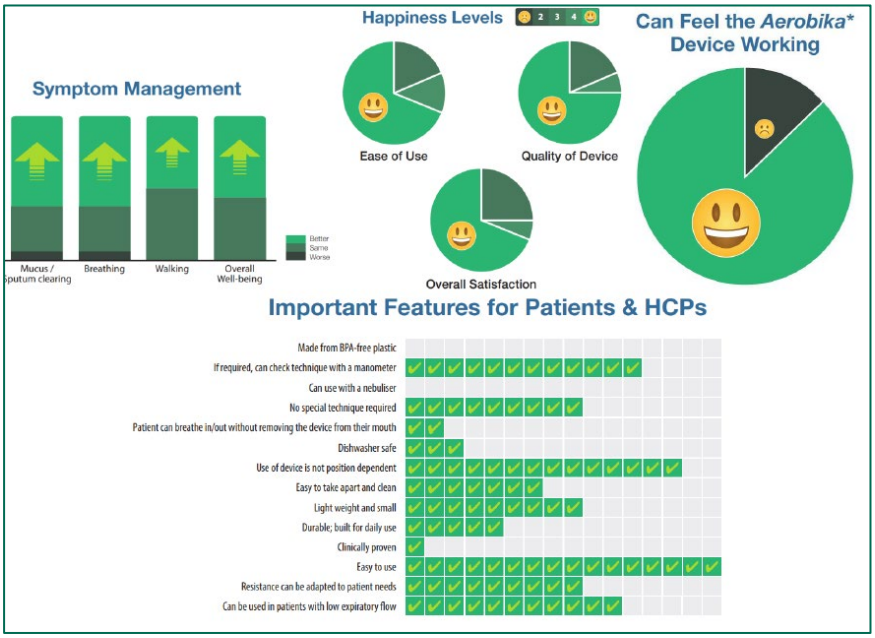
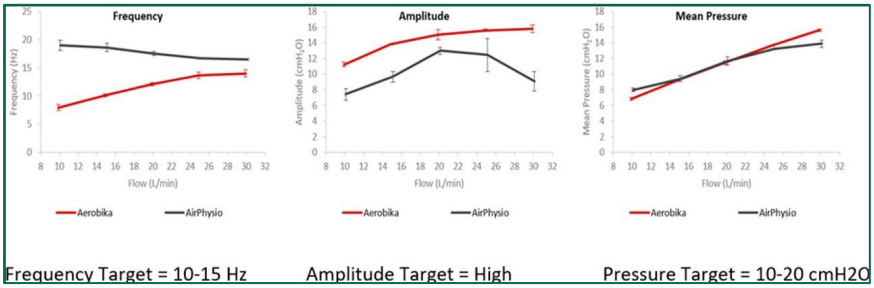
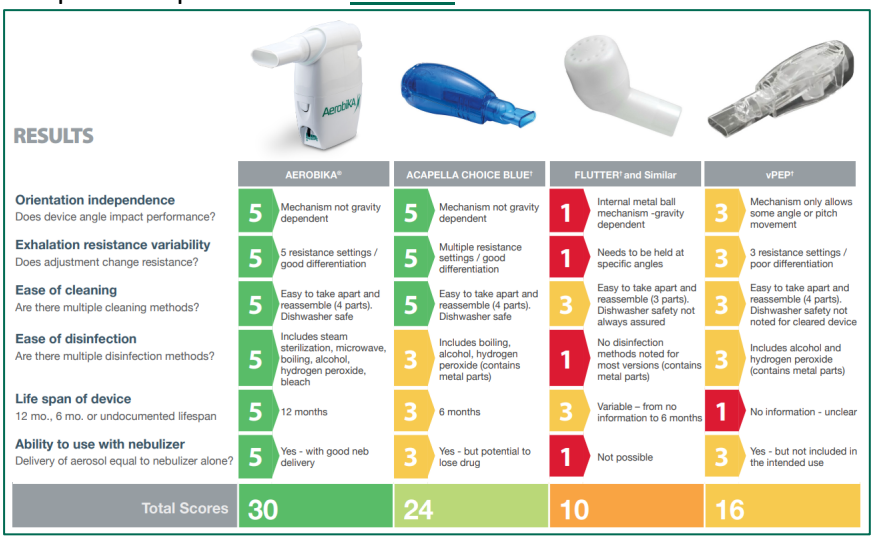
	Measures to Large n Patient Survey Data[20]	score relates to an improvement. Highlighting a statistically (p=0.009, paired two tailed t test) and clinically significant reduction of 9 points - more than 2 times the Minimum Clinically Important Difference (MCID). 97% of patients wanted to continue using the device. **Conclusions:** A highly significant improvement (both statistical and clinical) in SGRQ score was observed by patients following use of the ***Aerobika**** OPEP device within the 3 week cross-over clinical study. Although the large n patient survey was in non-phenotyped COPD patients using a non-validated survey, with therefore recognized limitations, there was still a degree of correlation to the clinical study outcomes with subjective improvements related to mucus clearance, ease of breathing, quality of life and coughing reported for a large number of patients.
	BRONCHIECTASIS	
7	***A Randomized Controlled Trial of 4 Weeks of Airway Clearance with Oscillating Positive End Expiratory Pressure Device Versus Autogenic Drainage in People with Bronchiectasis[21]***	**Background:** Airway clearance (AWC) is a fundamental component of care in bronchiectasis, but evidence of efficacy are few. Lung clearance index (LCI) is a promising measurement of ventilation inhomogeneity. Its responsiveness to AWC has not been demonstrated. **Aim:** To compare effects of two methods of AWC- Autogenic Drainage (AD) and Oscillating Positive Airway Pressure (oPEP) on LCI, spirometry, sputum quantity, and quality of life. **Methods:** Adult patients with bronchiectasis, naive to airway clearance, were randomized and instructed to daily AWC with either AD or oPEP (Aerobika, Trudell pharma, Canada). Weekly phone calls were performed to evaluate adherence to AWC. Multiple breath washout, spirometry, sputum volume and purulence, and QOL- B questionnaire were measured at randomization and after 4 weeks of AWC. **Results:** 51 patients were randomized and 49 completed the study (25 AD, 24 oPEP). Adherence was 87% (oPEP) and 88% (AD). LCI and FEV1 did not change between visits in either groups. Sputum quantity decreased in 12/24 of the oPEP group, and in 6/25 (24%) of the AD group, (p=0.044). 'Treatment burden' was worsened or unchanged in 70% of participants randomized to AD and 55% randomised to oPEP (p=0.038). During the study, 11 participants experienced a pulmonary exacerbation (6 AD, 5 oPEP). When these participants were excluded from the analysis, LCI improved in the oPEP group only (-0.59 vs. -0.1 in the AD group), without statistical significance (p=0.45). **Conclusions:** Sputum quantity was improved after one month of oPEP, without an increase in treatment burden. No change in LCI was seen with AWC.
8	***Noncystic Fibrosis Bronchiectasis: Regional Abnormalities and Response to Airway Clearance Therapy Using Pulmonary Functional Magnetic***	**Rationale and Objectives:** Evidence-based treatment and management for patients with bronchiectasis remain challenging. There is a need for regional disease measurements as focal distribution of disease is common. Our objective was to evaluate the ability of magnetic resonance imaging (MRI) to detect regional ventilation impairment and response to airway clearance therapy (ACT) in patients with noncystic fibrosis (CF) bronchiectasis, providing a new way to objectively and regionally evaluate response to therapy. **Materials and Methods:** Fifteen participants with non-CF bronchiectasis and 15 age-matched healthy volunteers provided written informed consent to an ethics board-approved Health Insurance Portability and Accountability Act-compliant protocol and underwent spirometry, plethysmography, computed tomography (CT), and hyperpolarized 3He MRI. Bronchiectasis patients

	Resonance Imaging[13]	also completed a Six-Minute Walk Test, the St. George's Respiratory questionnaire, and Patient Evaluation Questionnaire (PEQ), and returned for a follow-up visit after 3 weeks of daily oscillatory positive expiratory pressure use. CT evidence of bronchiectasis was qualitatively reported by lobe, and MRI ventilation defect percent (VDP) was measured for the entire lung and individual lobes. **Results:** CT evidence of bronchiectasis and abnormal VDP (14 ± 7%) was observed for all bronchiectasis patients and no healthy volunteers. There was CT evidence of bronchiectasis in all lobes for 3 patients and in 3 ± 1 lobes (range = 1–4) for 12 patients. VDP in lobes with CT evidence of bronchiectasis (19 ± 12%) was significantly higher than in lobes without CT evidence of bronchiectasis (8 ± 5%, *P* = .001). For patients, VDP in lung lobes with (*P* < .0001) and without CT evidence of bronchiectasis (*P* = .006) was higher than in healthy volunteers (3 ± 1%). For all patients, mean PEQ-ease-bringing-up-sputum (*P* = .048) and PEQ-patient-global-assessment (*P* =.01) were significantly improved post-oscillatory positive expiratory pressure. An improvement in regional VDP greater than the minimum clinical important difference was observed for 8 of the 14 patients evaluated. **Conclusions:** There was CT and MRI evidence of structure-function abnormalities in patients with bronchiectasis; in approximately half, there was evidence of ventilation improvements after airway clearance therapy.
	CYSTIC FIBROSIS	
9	***Effect of Aerobika* an Oscillating Positive Expiratory Pressure Device, on Lung Function in Pediatric CF Patients: A Longitudinal Analysis***[22]	**Background:** Airway clearance therapy (ACT) is a cornerstone of cystic fibrosis (CF) care. Multiple ACT modalities are available, but little evidence exists to support the use of one over another. **Objective:** Examine the effect of ***Aerobika****, an Oscillatory Positive Expiratory Pressure device (OPEP), on lung function over time in a pediatric CF clinic. **Methods:** Retrospective longitudinal study of lung function in pediatric patients at a single CF centre, stratified by ***Aerobika**** use. Measures: Lung function – ppFEV1. Exposure: Aerobika*, use alone or concurrently with a high frequency chest wall oscillating (HFCWO) vest, vs no ***Aerobika*.*** Study period: 2016-2021. Study population: N=146. Statistical Analysis: Longitudinal analysis used mixed modelling, which contains both fixed effects and random effects. We allow for a random intercept and slope. Stata 15. **Results:** ***Aerobika**** use is associated with 7.2 higher ppFEV1 (p=0.009). The association is stronger for children and adolescents whose parents do not have a college degree (11.2, p=0.007). **Conclusions:** ***Aerobika****, used alone or with a HFCWO best, may help preserve lung function. Effect size may be larger for older patients, 1.5% (p=0.074) less annual ppFEV1 decline in patients 9 and older. The benefit is greater in less-educated families; may help reduce inequities in outcomes.
10	***Evaluating the Use of an Oscillatory Positive Expiratory Pressure Device as Part of***	**Objectives:** It is necessary for children with Cystic Fibrosis (CF) to undertake regular Airway Clearance Techniques (ACT) due to increased secretions, inflammation, and potential deficits in lung function. Maintaining adherence to ACTs is a challenge for all people with CF. In order to improve adherence and quality of care, we introduced and evaluated the use of an Oscillatory Positive Expiratory Pressure (OPEP) device in addition to current ACT techniques. **Methods:** 16 patients were recruited from a paediatric CF clinic in North Wales to evaluate the

	Airway Clearance in Paediatric Patients with Cystic Fibrosis[14]	Aerobika* OPEP device • Age 6-16 yrs • 10 male, 6 female • 3-month period. Patients were advised on implementing the use of the Aerobika* device for 15 breaths over 9 minutes in conjunction with their own individual ACT which included Active Cycle of Breathing (ACBT, 3 cycles), Forced Expiratory Techniques (FET) and in some cases Autogenic Drainage (AD). A pressure manometer was provided for some patients, depending on age and capacity prior to the trial. Telephone follow-up at 1 month post initiation was undertaken and a 5-point questionnaire including feedback from both patient/parent and physiotherapist at 3 months. Results: Evaluations were completed by 10 patients and 6 parents. All respondents (16) reported that they would continue using the device. Frequency of use was typically 3x daily and duration of use was an average of 9 minutes.  **Conclusion**: All 16 participating patients benefited from the use of the Aerobika* device to supplement their individual evidence-based regime of Airway Clearance Techniques (ACT). The Aerobika8 OPEP device was found to be a useful device for supplementing ACT for this Paediatric patient group with CF. Dependent on age, it was particularly useful to use the manometer device to regulate and modify changes to patient treatments dependent on their symptoms and disease progression. Both patients and parents reported improved adherence and frequency of treatment within their ACT.
STUDIES COMPARING OPEP DEVICES AND AIRWAY CLEARANCE TECHNIQUES		
11	***Assessment of Two Oscillating Positive Expiratory Pressure (OPEP) Devices***	**Rationale:** OPEP devices are often used therapeutically in order to aid airway clearance where excess mucus is a challenge, such as in bronchiectasis, CF and COPD. Ease of use, ability to clean and adaptability to use with nebulizers are real world differentiators for different types of OPEP device, however the mechanism of device action can also differ. This laboratory study compared an

	(Aerobika* vs. AirPhysio): How do the Differing Mechanisms of Action Impact Lab Performance[23]	established, clinically supported OPEP device with a recently introduced one that is based on older technology. Key in-vitro performance parameters were compared. **Methods:** ***Aerobika**** (Trudell Medical International, Canada) and AirPhysio (AirPhysio, Australia) OPEP devices (n=3) were assessed at steady expiratory flows of 10–30L/min using a flow generator (Resmed VPAP III), flow meter (TSI 4000), pressure tap and computer for data collection and analysis. Average positive pressure, pulse amplitude and pulse frequency were determined for each device. **Results:** As each device can be operated at different resistances, the values at medium resistance are reported in the figure below:  Frequency Target = 10-15 Hz Amplitude Target = High Pressure Target = 10-20 cmH2O ***Figure 19: Each device operated at different resistances, the values at medium resistance.*** **Discussion/Conclusions:** For effective performance, frequency is typically desired to be in the 10–15 Hz range, mean pressure ideally between 10–20 cm H2O, and pulse amplitude as large as possible. The results for the two devices show that although mean pressures are similar across the range of flow rates, the amplitudes are higher for the ***Aerobika**** OPEP device and the frequencies are more often in the desired range. The observed differences are probably due to the fact that each device operates according to a different mechanical principle. What is clear from these results is that, in addition to real world usability assessments, it is important to understand that each OPEP device can perform differently mechanically. Hence, when selecting an OPEP device for a patient, the existence of clinical evidence supporting efficacy, as well as patient preference, should be considered. All devices will not perform the same.
12	***Retrospective Cohort Study Comparing an Oscillating Positive Expiratory Pressure (OPEP) Device vs Positive Expiratory Pressure (PEP) Devices in***	**Rationale:** For patients with COPD, acute exacerbations are the most common reason for hospital admissions, with approximately 1 in 5 patients requiring re-hospitalization within 30 days of discharge. The Aerobika* OPEP device has previously been shown to significantly improve outcomes such as ease in bringing up sputum, forced vital capacity, quality of life, and exacerbations, when added to standard of care. This retrospective cohort study described real-world outcomes among patients with COPD or chronic bronchitis, comparing the Aerobika* OPEP device to the similar, but more basic PEP device, which does not generate pressure pulses. **Methods:** IQVIA's Charge Detail Master (CDM) hospital claims database linked to medical (Dx) and prescription

	Patients with Chronic Obstructive Pulmonary Disease (COPD) or Chronic Bronchitis on Hospital Readmissions at 30 Days[24]	claims (LRx) data were used to identify patients receiving the ***Aerobika**** (Trudell Medical International) OPEP device or any PEP device between September 2013 and November 2018; the index date was the first CDM record with an OPEP/PEP device. Patients were required to be ≥18 years of age and have ≥1 hospital and LRx/Dx records within 12 months before and after index, ≥1 COPD/chronic bronchitis diagnosis during the index visit and no asthma diagnosis before index or post-operative device use within 30 days before index. Patients receiving the Aerobika* OPEP device were propensity score (PS) matched to patients receiving a PEP device based on demographics and baseline comorbidities, history of exacerbations and drug therapy. The proportion of patients experiencing a COPD/chronic bronchitis related readmission within 30 days of the index visit was evaluated. **Results:** After 1:1 PS matching, 588 patients receiving ***Aerobika**** and 588 receiving PEP were compared. Baseline characteristics were well-balanced. Patients using Aerobika* OPEP had a 31% reduction in COPD/chronic bronchitis related readmission within 30 days of the index hospitalization compared to those patients with a PEP device (12.4% vs. 17.9%; p=0.006). **Conclusions:** Results from this study demonstrate a reduction in COPD/chronic bronchitis related readmissions within 30 days of Aerobika* OPEP device therapy initiation compared to PEP therapy. This further supports the use of the Aerobika* OPEP device as an add-on to usual care to manage COPD/chronic bronchitis patients' post-exacerbation and provides some evidence as to the additional benefit of pressure oscillations over standard PEP.
13	***Patient Centered Considerations when Selecting an Oscillating Positive Expiratory Pressure (OPEP) Device[25]***	**Introduction:** Efficacy is a major aspect when selecting an OPEP device for airway clearance. However, usability of the device is also another very important aspect to consider in device selection as this may affect adherence to the therapy. This study compares patient use factors for several different OPEP devices (covering design improvements introduced over time) with the aim of highlighting usability differences, as it may help with device selection. **Methods:** Four different OPEP devices were evaluated. These were: 1. ***Aerobika®*** (Monaghan Medical) 2. Acapella Choice Blue† (Smiths Medical) 3. Flutter† and similar (multiple manufacturers – e.g. Pari OPEP, AirPhysio, Gelomuc†) 4. vPEP† (DR Burton). Previous studies have outlined the performance differences between devices, due to differences in mechanical action, which are likely to result in different patient outcomes. The patient 'friendly' factors that were assessed to evaluate usability of each device were: A. Orientation independent use, B. Ability to change exhalation resistance, C. Ease of cleaning, D. Ease of disinfecting, E. Life span of device, and F. Ability to use connected to a nebulizer. For each factor, a score of either 1, 3 or 5 (the higher the better) was assigned, enabling a total score to be calculated.

		The scoring justification is supported from device leaflet content and previous publications. **Results:** See attached table.  *Figure 20: Patient 'friendly' factors that were assessed to evaluate usability of each device.* **Conclusions:** The many differences in device ease of use and flexibility that are shown in the table will hopefully provide some guidance when selecting the best device for each patient. Combining usability findings with evidence of likely efficacy when adherent will enable a more objective selection of device. Notwithstanding that the patient themselves will provide good validation of the correct choice.
14	***Non-Pharmaceutical Techniques for Obstructive Airway Clearance Focusing on the Role of Oscillating Positive Expiratory Pressure (OPEP): A Narrative Review.***[26]	Mucus secretion in the lungs is a natural process that protects the airways from inhaled insoluble particle accumulation by capture and removal via the mucociliary escalator. Diseases such as cystic fibrosis (CF) and associated bronchiectasis, as well as chronic obstructive pulmonary disease (COPD), result in mucus layer thickening, associated with high viscosity in CF, which can eventually lead to complete airway obstruction. These processes severely impair the delivery of inhaled medications to obstructed regions of the lungs, resulting in poorly controlled disease with associated increased morbidity and mortality. This narrative review article focuses on the use of non-pharmacological airway clearance therapies (ACTs) that promote mechanical movement from the obstructed airway. Particular attention is given to the evolving application of oscillating positive expiratory pressure (OPEP) therapy via a variety of devices. Advice is provided as to the features that appear to be the most effective at mucus mobilization.
	Evaluation of Functional Characteristics of 4 Oscillatory Positive	Background: Oscillatory positive expiratory pressure (OPEP) is an airway clearance therapy that delivers positive pressure and air-flow oscillations during exhalation. This study described functional characteristic differences of 4 OPEP devices during an active exhalation in a simulated model. We hypothesized peak pressure

	Pressure Devices in a Simulated Cystic Fibrosis Model [26,27,Error! Bookmark not defined.]	(Ppeak), positive expiratory pressure (PEP), oscillatory frequency (f), and pressure amplitude will differ, depending upon the device used, device resistance setting, and time (repeated consecutive active exhalations through the device). Methods: The ASL 5000 was scripted to simulate pulmonary mechanics of a pediatric cystic fibrosis patient with moderate to severe lung disease. Airway resistance was standardized at 17.1 cm H2O/L/s, pulmonary compliance at 42.1 mL/cm H2O, active exhalation at 22 breaths/min, and tidal volume at 409 mL. Resistance settings for the Acapella, RC-Cornet, Flutter, and ***Aerobika**** were adjusted to low, medium, and high. Values for f, Ppeak, PEP, and pressure amplitude were recorded for 1 min and graphically displayed. Results: Significant effects for time, device, and resistance ($P < .01$) were noted for Ppeak, PEP, and pressure amplitude at each resistance level, demonstrating that the devices functioned differently as more than one repetition of a series of consecutive active exhalations are performed. Significant interaction effects for device, resistance level, and time indicate inconsistent output for Ppeak ($P < .01$), PEP ($P < .01$), and pressure amplitude ($P < .01$). Oscillatory f values fell within the respective manufacturers' operational parameters. The ***Aerobika**** provided the most consistent pressure amplitude across resistance settings and produced the highest mean pressure amplitude at medium and high resistance settings. **Conclusions:** Statistically significant and clinically relevant variations in Ppeak, PEP, and pressure amplitude occurred between devices and within a device, as the resistance setting changed. The combination of device, time, and resistance settings affects OPEP device output for pressure, amplitude, and oscillatory frequency. Functional variations may impact therapeutic effectiveness, warranting additional study to determine clinical impact.

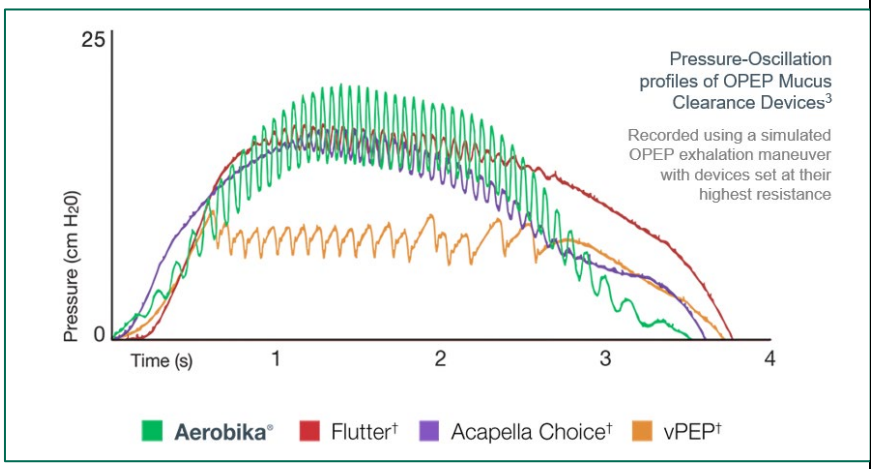


Figure 21: Highest peak pressure + largest oscillations help create more force to clear your lungs [26,27,28]

Oscillations that are apparent from the start through to the end of breath make it easier for patients who may have difficulty maintaining high exhalation pressures.

- Percentage of exhaled breath with oscillations:
  - 81% ***Aerobika**** OPEP Device
  - 67* Acapella Choice†
  - 62% Flutter†

Higher amplitudes indicate greater changes in pressure differentials which can create stronger shear forces that reduce the viscoelastic properties of secretions[1], enabling secretions to be cleared from the airways.

- The ability to generate & maintain significant pressure oscillations (high amplitude) across full exhalation is key for treatment effectiveness.
  - Average oscillation pressure amplitude (cm H^2O):
  - 13.9 ***Aerobika**** OPEP Device
  - 5.8 Acapella Choice†
  - 3.0 Flutter†

The frequency of the oscillations is an important waveform characteristic.

- The frequency of natural airway cilia movement has been shown to be optimal for mucus expectoration at approx. 13 Hz. This supports more efficient natural mucociliary clearance.

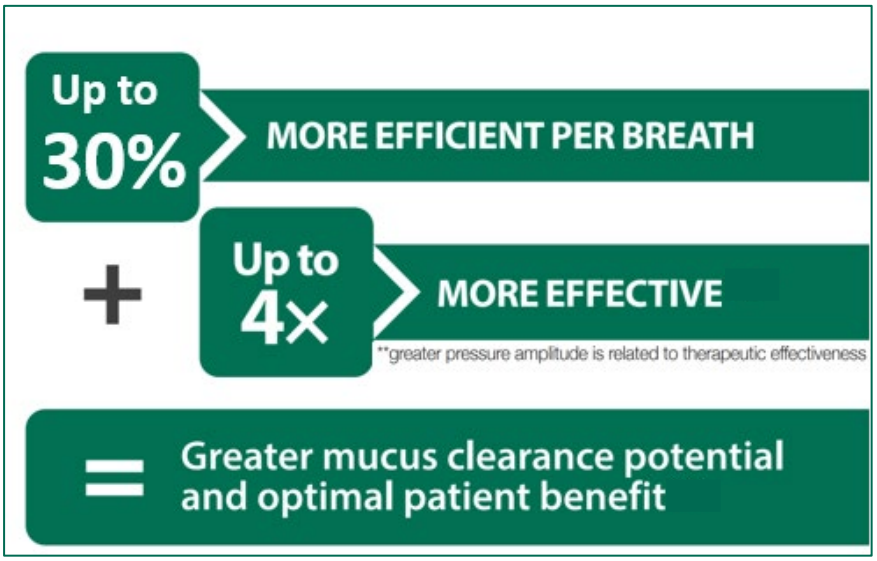


Figure 22: The Most Efficient and Effective OPEP Device Tested [27,28]

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