Laboratory Assessment of Three Oscillating Positive Expiratory Pressure (OPEP) Devices: How do the Differing Mechanisms of Action Impact Performance with Considerations for Clinical Relevance

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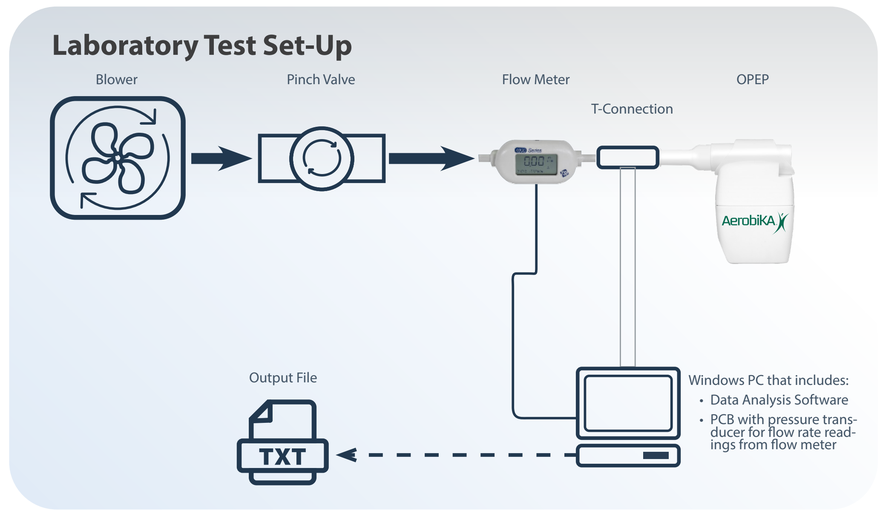
INTRODUCTION

OPEP devices are often used therapeutically to aid airway clearance where excess mucus is a challenge, such as in COPD, bronchiectasis, and cystic fibrosis. Ease of use, cleaning options, adjustable resistance, and ability to use in combination with a nebulizer are real world factors that differentiate various OPEP devices. In addition, OPEP devices often have differing mechanisms of action. This laboratory study compared three different OPEP devices, each with a distinctly different mechanism of action in producing the OPEP. Key in-vitro performance parameters were compared.

METHODS

Aerobika* (Trudell Medical International), Acapella Choice Blue† (ICU Medical), and GeloMuc† (Pohl Boskamp) 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. Pulse frequency, average positive pressure, and pressure pulse amplitude were determined for each device.

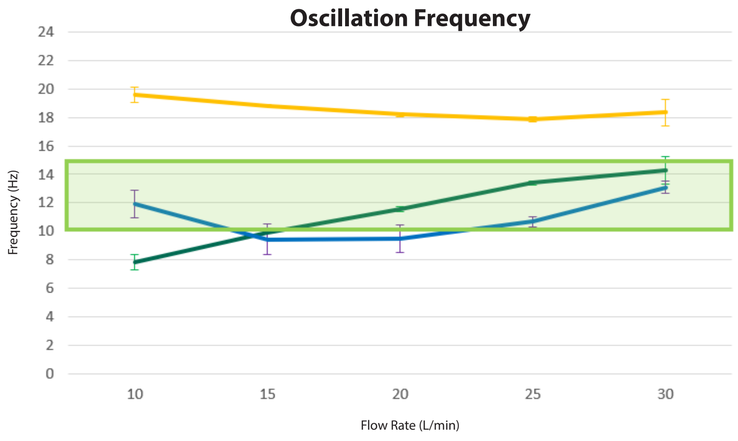


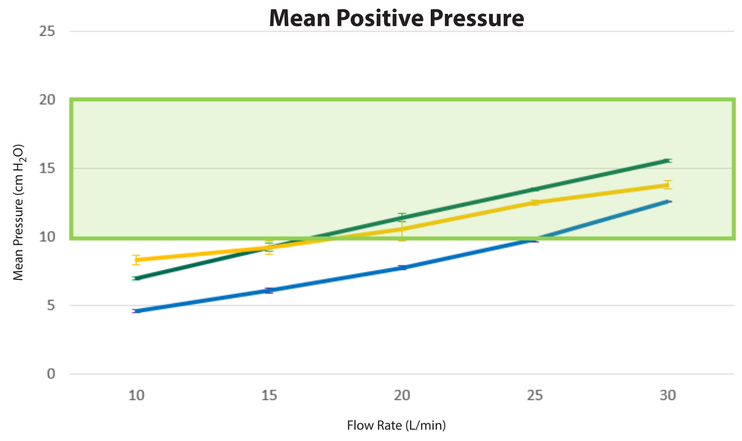
Aerobika* OPEP Device
(Trudell Medical International)

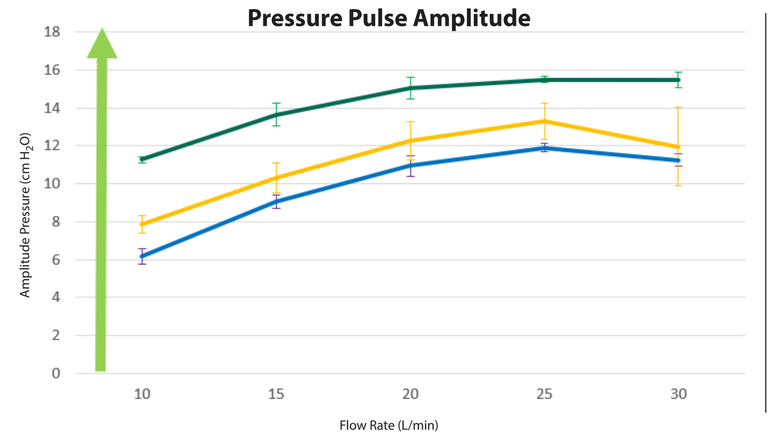
Acapella Choice Blue†
(ICU Medical)

GeloMuc†
(Pohl Boskamp)

RESULTS/DISCUSSION

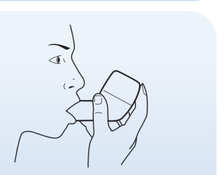






Aerobika* OPEP Device
Resistance setting 3

Acapella Choice Blue†
Resistance setting 3



GeloMuc†
Horizontal position

Each device can be operated at different resistances. The values at medium resistance are reported in this study as this is typically the recommended starting setting.

For effective performance, frequency is typically desired to be in the 10-15 Hz range,[1] mean pressure ideally between 10-20 cm H_2O,[2] and pulse amplitude as large as possible.[3] Higher amplitudes indicate greater changes in pressure differentials which can create stronger shear forces that reduce the viscoelasticity of bronchial secretions[2] and the adhesion of secretions to the bronchial walls, enabling mobilization and clearance.[3] The results for the three devices show that for frequency, Aerobika and Acapella are mostly in the desired range while GeloMuc is outside. For average pressure, Aerobika and GeloMuc are mostly in the desired range while Acapella is below. For pressure pulse amplitude, Aerobika is the highest across all flow rates with GeloMuc and Acapella lower and similar to each other. The observed differences are probably due to the fact that each device operates according to a different mechanical principle.

Study limitations include the fact that this study is lab based (rather than clinical) and that flow rates above 30 L/min were not tested. However, as a comparative study, the results still have value.

CONCLUSIONS

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, and that this may impact device performance and potentially the clinical benefit of the device.**

In this study, the Aerobika* OPEP device performed the best overall as it was most often in the desired range for frequency and mean pressure, and produced the greatest pressure pulse amplitudes. 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.

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1 Silva C, *et al*. Respiratory Care 2009;54(11):1480-1487 **2** Coppolo D, Schloss J, Suggett J, Mitchell, J. Non-Pharmaceutical techniques for obstructive airway clearance focusing on the role of oscillating positive expiratory pressure (OPEP): a narrative review. Pulm Ther. 2021. **3** Van Fleet H, *et al*. Respiratory Care. 2017;62(4):451-458.