A Laboratory Assessment into the Efficiency and Effectiveness of Different Oscillating Positive Expiratory Pressure Devices by Means of Patient Simulated Expiratory Waveforms

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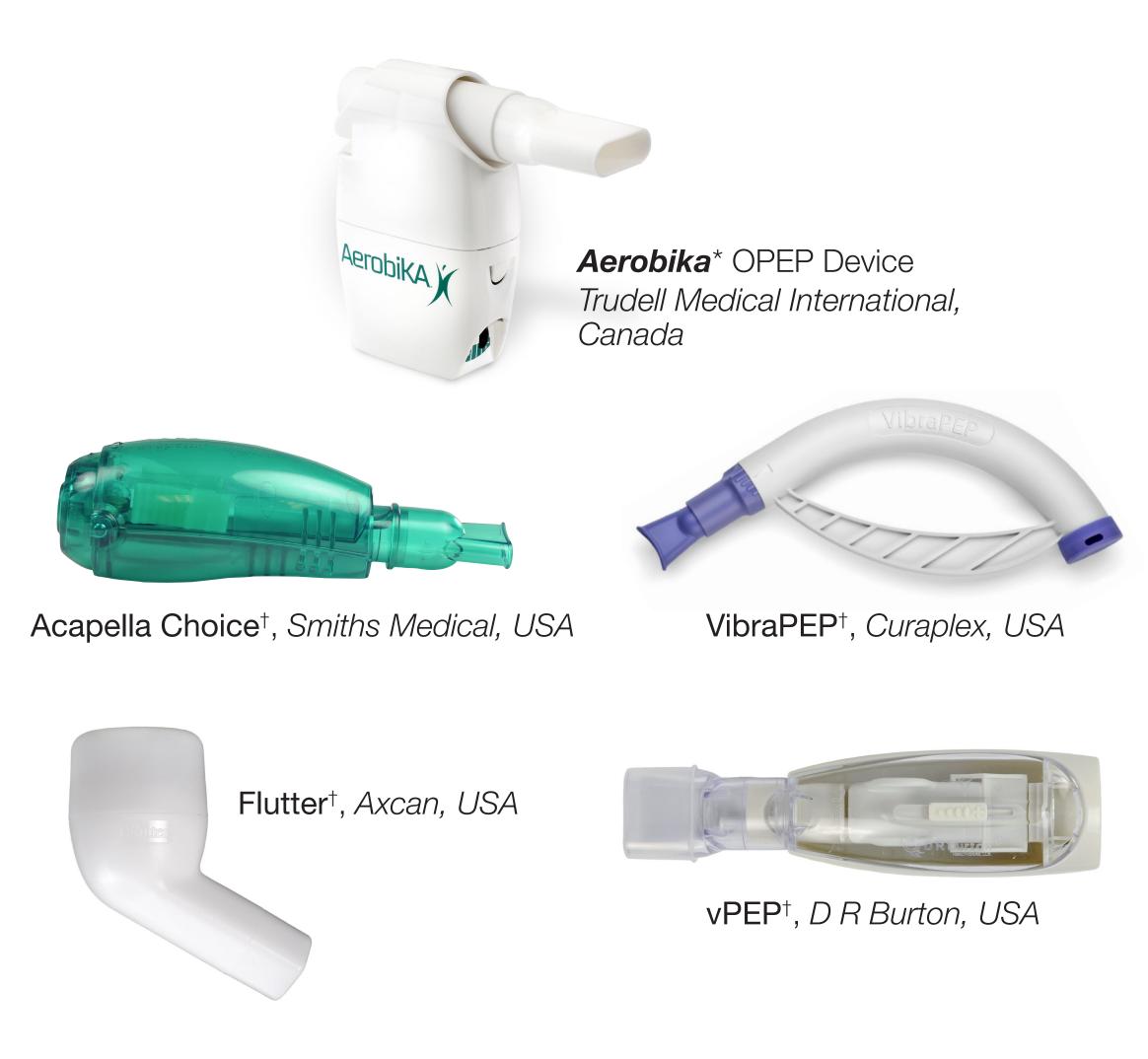
RATIONALE

- Oscillating Positive Expiratory Pressure (OPEP) devices can be used to manage a variety of conditions, such as CF, COPD, bronchiectasis and post-surgical recovery
- OPEP devices function through a general mechanism of opening/vibrating airways and loosening mucus, however, the specific mechanism by which this is achieved differs between different devices
- This investigation assesses the positive pressure oscillation waveforms of various devices and evaluates each critically in terms of consequential efficiency and effectiveness of action

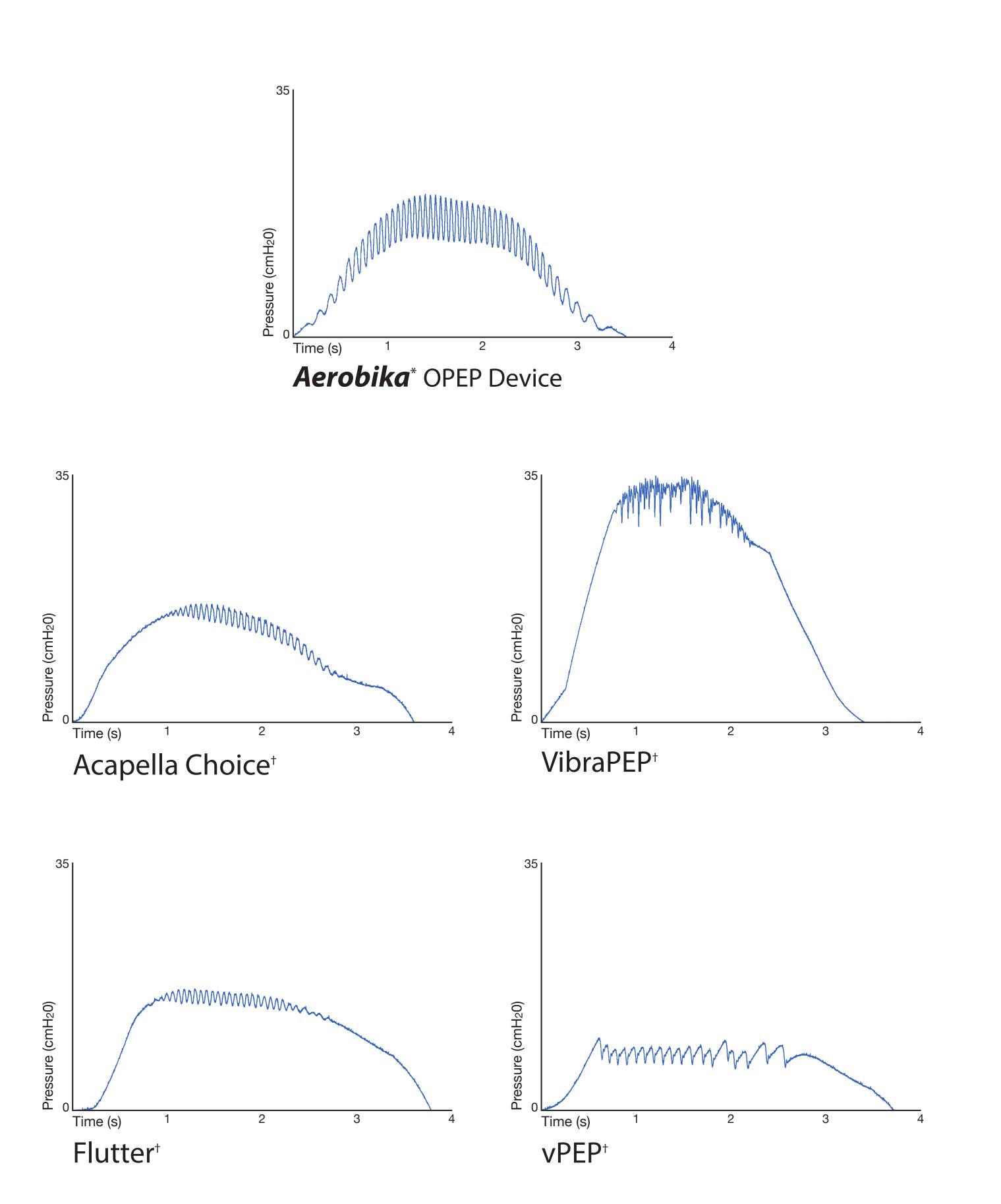
MATERIALS & METHODS

- A simulated OPEP exhalation maneuver was generated based on previous research¹ in which a flowmeter (TSI4040 TSI, US) was used to record the waveforms of 5 healthy adults
- An average profile was then scaled so the Peak Expiratory Flow rate (PEF) was 30 L/min, thereby being more patient representative

- This patient representative waveform was then used to operate, via a breathing simulator (ASL5000 IngMar, US), a range of different OPEP devices
- n=3 devices, 3 replicates of each

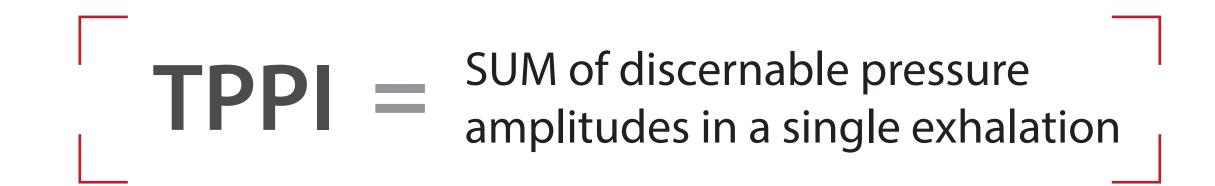


 The pressure/time waveforms were recorded (Pressure Transducer, Honeywell, USA) for each device, set at their highest resistance to enable direct comparison



In addition, various critical performance parameters were determined

- Percentage of exhaled breath with discernable oscillations (> 1.0 cm H₂O), tosc [%]
- Average oscillation amplitude
- Total Pressure Pulse Impact (TPPI)



RESULTS

- Each device waveform had its own unique pattern, as summarized in Table 1
- In terms of the percentage of breath with oscillations and the average oscillation pressure amplitude, the *Aerobika** OPEP device exhibited the highest values for both, with the vPEP[†] and Flutter[†] devices the lowest for each respectively

Table 1: Device Performance Comparison

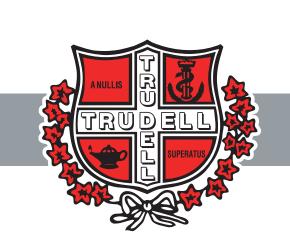
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Device	tosc [%]	Avg Amp [cm H ₂ O]	# of osc	TPPI [cm H ₂ O]
Aerobika * Device	81%	13.9	36	495
vibraPEP [†]	69%	9.4	27	256
Acapella Choice [†]	67%	5.8	41	236
Flutter [†]	62%	3.0	46	139
vPEP [†]	45%	4.5	25	112

CONCLUSIONS

- TPPI assesses both efficiency and effectiveness of the device
 - Efficiency relates to the percentage of breath with oscillations
 - Effectiveness relates to the number and amplitude of the oscillations
- The therapeutic effectiveness of the air flow oscillations, as assessed here via the TPPI value, is considered to be dependent, in part, on the ability of the device to generate and maintain a pressure amplitude or turbulent spike throughout the maneuver²
- The TPPI values showed the Aerobika* OPEP device to be the most effective, with double the value of the second ranking device

CLINICAL IMPLICATIONS

 Such differences in laboratory performance should be considered when evaluating clinical performance studies and when selecting a device for clinical practice



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Meyer A et al, Assessment of Oscillating Positive Pressure Devices by Means of Adult Expiratory Waveforms: A Laboratory Study, Am J Respir Crit Care Med 2014; 189:A303

Van Fleet et al, Evaluation of Functional Characteristics of 4 Oscillatory Positive Pressure Devices in a Simulated Cystic Fibrosis Model, Resp Care 2017;62(4):451-458.