Background: After reviewing the literature on both high flow and low flow Acapella devices, it was determined that most researchers evaluated only three frequency dial settings. Due to this gap, we chose to determine the expiratory resistance at each frequency dial setting for both high flow and low flow Acapella devices, as patient effort (amplitude) is increased on an electronic lung simulator. Hypothesis: 1) As the frequency dial setting is increased on the Acapella, the expiratory resistance will increase, and 2) the expiratory resistance will increase as patient expiratory effort (amplitude) is increased.

Methods: Each Acapella device was attached, separately, via a female-to-female adapter to the donation of the Acapella devices. A female 20 cm H2O, 30 cm H2O, and 40 cm H2O were simulated patient effort, respectively. The Acapella devices were set to the highest setting. Next, data was recorded for 20 consecutive breaths. The Acapella device to one of the five settings, altering the frequency of vibratory pressure waves. After reviewing the literature on wide range of gaps for clinicians to consider when providing Acapella therapy, leaving the question as to whether or not the expiratory resistance may be a factor in the Acapella device.

Results: As the frequency dial setting was increased from 1 to 5 on each Acapella device, the expiratory resistance increased. Also, the expiratory resistance increased when the amplitude increased on each device at every frequency dial setting. The calculated expiratory resistance, as the dial setting was increased, is as follows:

- Green 1 device: 10 cm H2O: the range was 9.71-103.33 cm H2O/sec
- Blue 1 device: 10 cm H2O: the range was 12.96-38.24 cm H2O/sec
- Green 2 device: 10 cm H2O: the range was 11.81-127.11 cm H2O/sec
- Blue 2 device: 10 cm H2O: the range was 22.97-103.43 cm H2O/sec
- Green 1 device: 20 cm H2O: the range was 15.87-25.48 cm H2O/sec
- Blue 1 device: 20 cm H2O: the range was 33.8-39.58 cm H2O/sec
- Green 2 device: 20 cm H2O: the range was 15.87-25.48 cm H2O/sec
- Blue 2 device: 20 cm H2O: the range was 38.4-44.17 cm H2O/sec
- Green 1 device: 30 cm H2O: the range was 18.27-26.22 cm H2O/sec
- Blue 1 device: 30 cm H2O: the range was 34.5-47.02 cm H2O/sec
- Green 2 device: 30 cm H2O: the range was 18.27-26.22 cm H2O/sec
- Blue 2 device: 30 cm H2O: the range was 38.4-44.17 cm H2O/sec
- Green 1 device: 40 cm H2O: the range was 21.64-34.50 cm H2O/sec
- Blue 1 device: 40 cm H2O: the range was 21.64-34.50 cm H2O/sec
- Green 2 device: 40 cm H2O: the range was 25.83-39.58 cm H2O/sec
- Blue 2 device: 40 cm H2O: the range was 27.25-44.17 cm H2O/sec

Discussion: The purpose of this study was to evaluate the effect of frequency dial setting and patient expiratory effort on expiratory resistance. As noted in the results, as the frequency dial setting was increased, expiratory resistance increased and expiratory resistance increased with increased amplitude. While performing this study, it was noted that at an Amplitude of 20 cm H2O, the expiratory resistance did not oscillate and resulted in an extremely high expiratory resistance (see table for exact values). It is possible that a patient’s disease state may result in increased expiratory resistance and may affect the performance of the device, potentially reducing their expiratory flow rate and reducing the oscillations within the device. Patients with high airway resistance may be able to increase their expiratory effort due to muscle fatigue or muscle weakness. Further research would need to investigate this concept and include assessing patients’ airway resistance, as this could affect their expiratory flow rate and the expiratory resistance of the device.

The Acapella devices demonstrated a varying expiratory resistance as they are used over time.

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