

Evaluation of Effect of Breathe Ventilation System on Work of Breathing in COPD patients

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Disclosure Slide- Matthew Cohn, M.D.

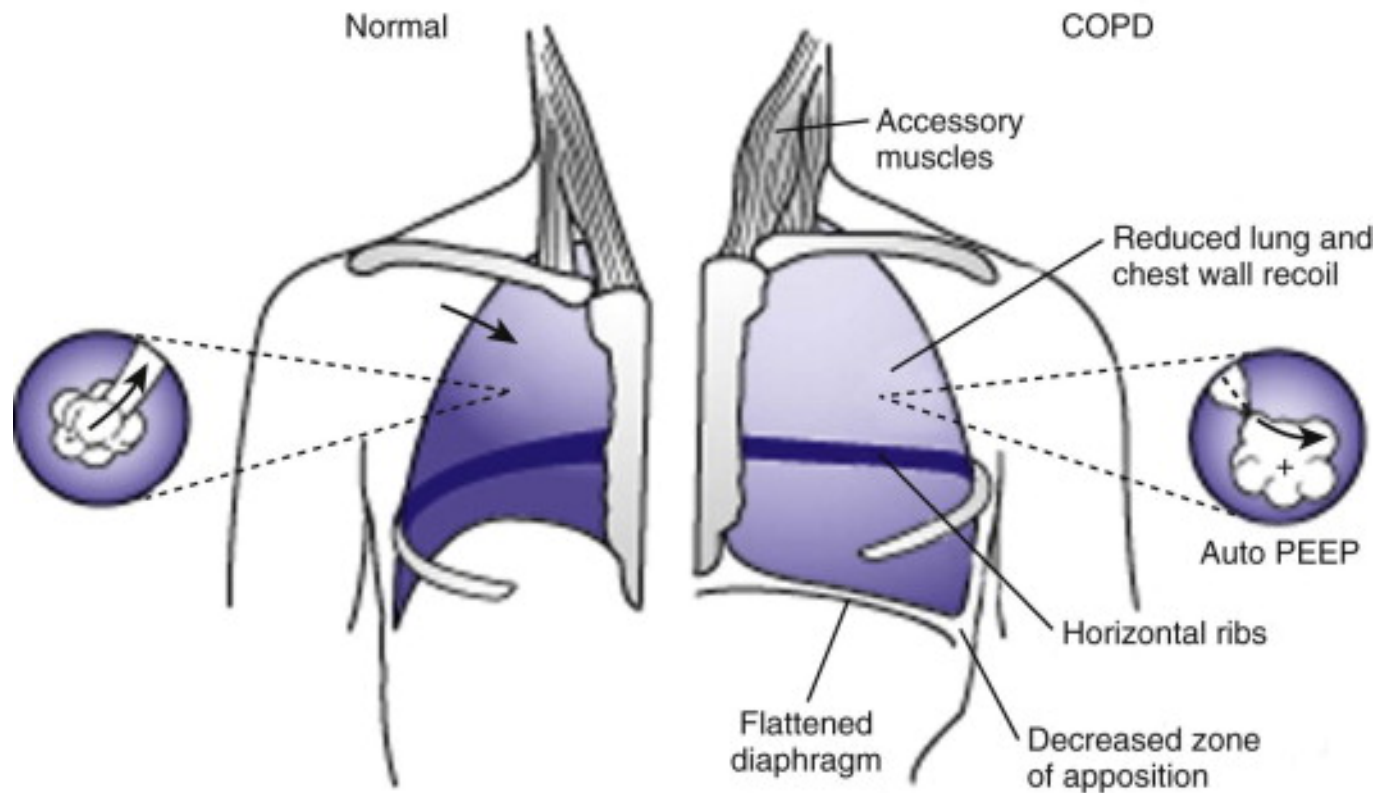
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Background

- Severe COPD limits functional capacity partly via increases in work of breathing, placing an increased load on the inspiratory muscles

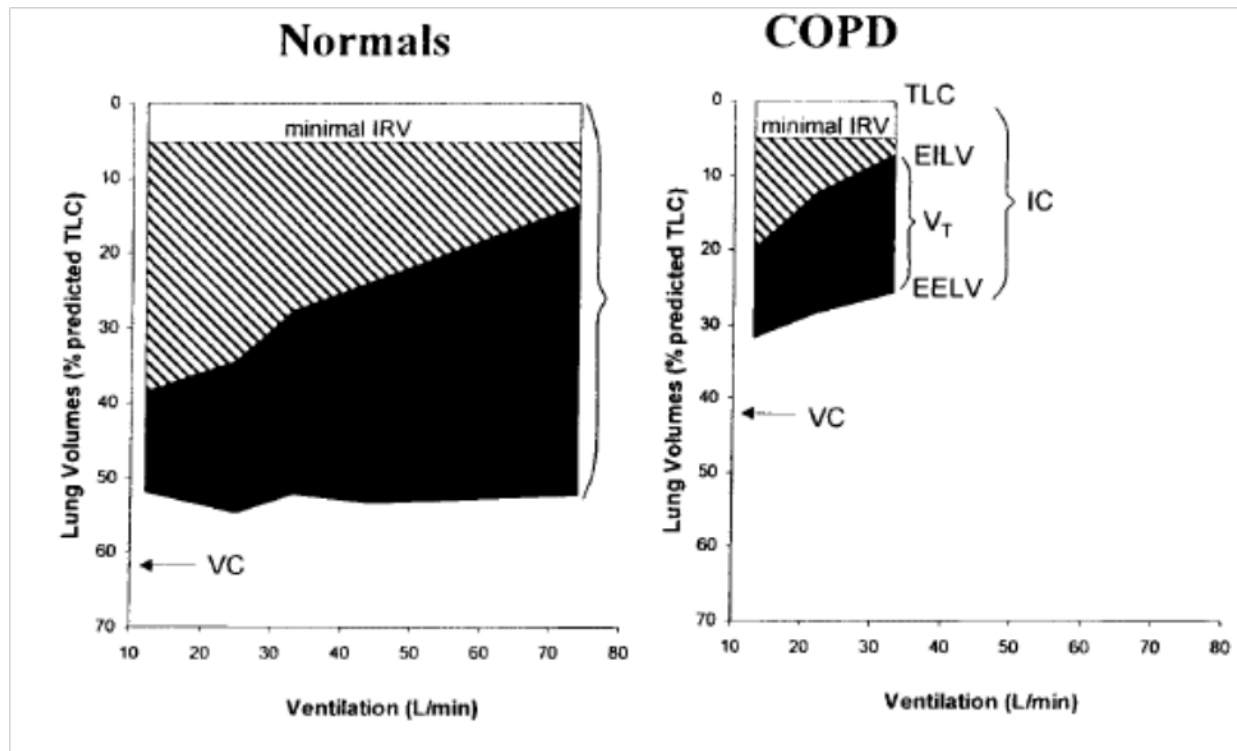
Hill NS. Current concepts in mechanical ventilation for chronic obstructive pulmonary disease. Semin Respir Crit Care Med 20:375-393, 1999.

Background



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Background



O'Donnell DE et al. Dynamic Hyperinflation and Exercise Intolerance in Chronic Obstructive Pulmonary Disease. *AJRCCM* 2001(164); 770-777.

Background

- The combination of inspiratory pressure support and PEEP reduces work of breathing in patients with severe COPD
 - Extrinsic PEEP counterbalances intrinsic PEEP
 - Inspiratory pressure support assists inhalation
- CPAP, PSV, and PAV can augment exercise capacity in rehabilitation settings
 - Use for everyday activities in patients with severe COPD is limited by size and weight of the devices

Appendini L, Purro A, Patessio A, et al. Partitioning of inspiratory muscle workload and pressure assistance in ventilator-dependent COPD patients. *Am J Respir Crit Care Med.* 1996 Nov;154(5):1301-9

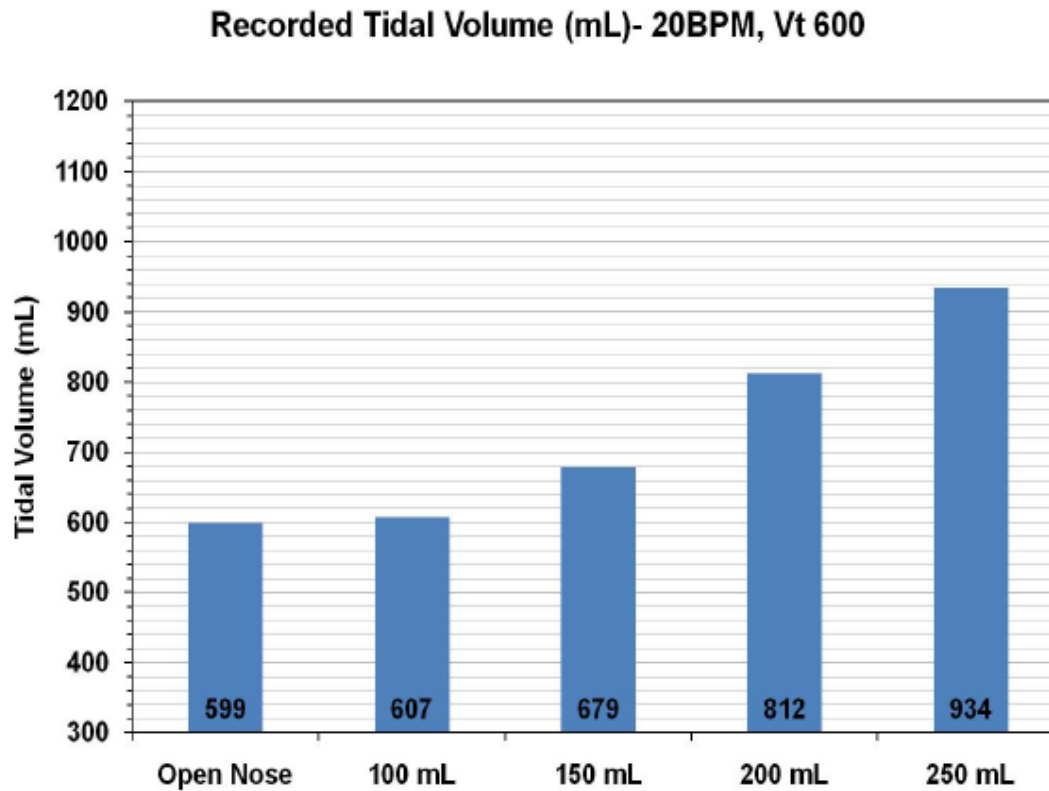
Breathe NIOV Ventilator

- The Breathe Non-Invasive Open Ventilation (NIOV) System is a small, lightweight FDA-approved device designed to optimize portability
 - Battery powered
 - Weighs less than 2lbs (without oxygen source)
 - Delivers three different volumes which can be set according to level of exertion
 - Utilizes a specially-designed nasal mask which incorporates ambient air via the Bernoulli Principle to augment airflow

Breathe NIOV Ventilator



Breathe NIOV Ventilator



Study Design

- **Inclusion Criteria**

- Age > 18
- Severe COPD (GOLD III or IV)
- Increased work of breathing evidenced by SCM contraction during inspiration

- **Exclusion Criteria**

- AECOPD with hospitalization within last month
- Requires supplemental oxygen > 5L to maintain 90% saturation
- Severe dyspnea at rest

Study Design

- Nasal catheters with balloons inserted into the stomach and esophagus
 - Pdi measured as difference between P_{ga} and P_{es}
- Respiratory inductive plethysmography using thoracic and abdominal bands applied to measure TV
- Transcutaneous probe applied to the ear to measure oxygen saturation and serum CO_2

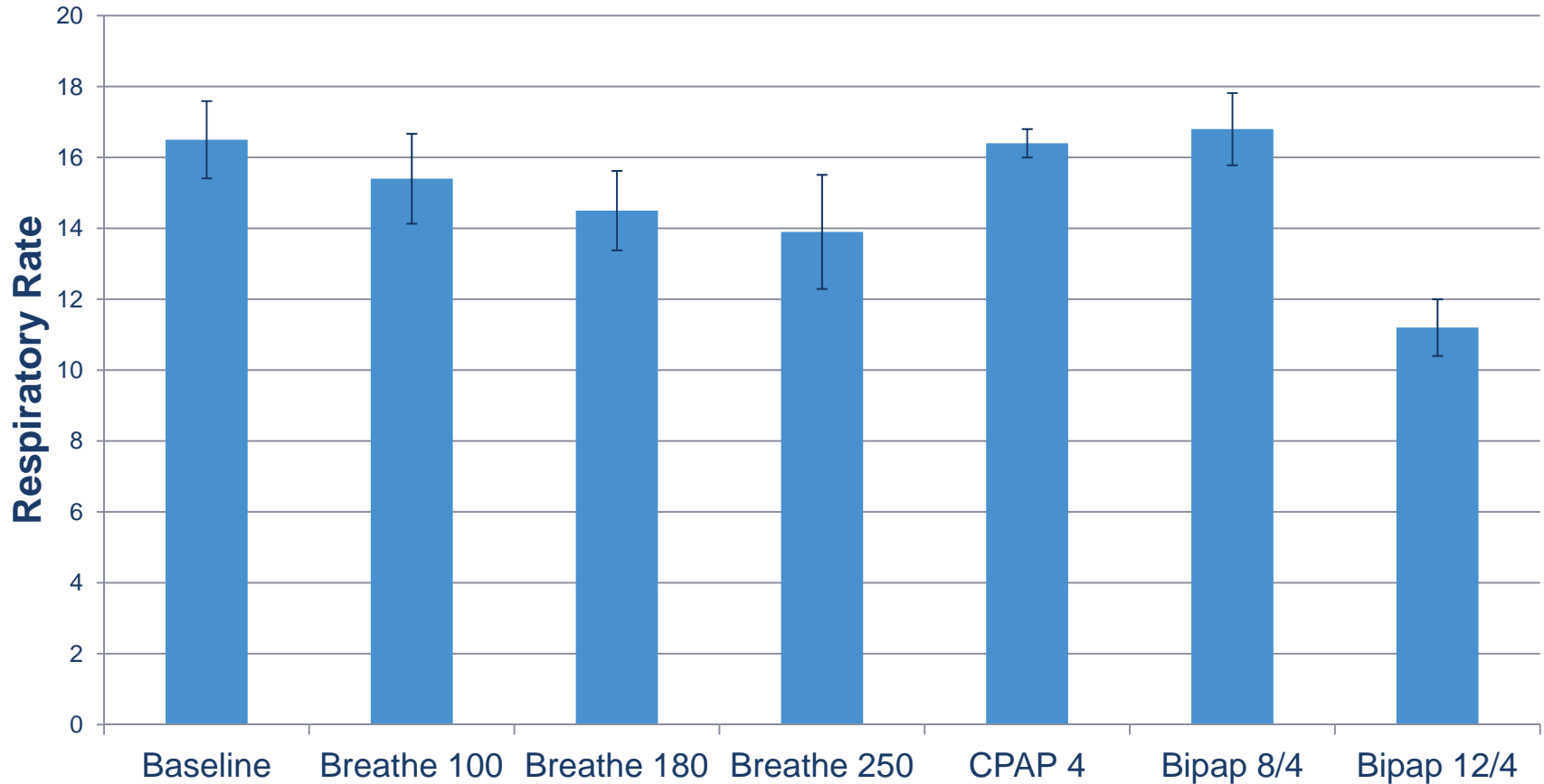
Study Design

- Measurements taken at the following conditions:
 - Baseline (with or without O₂)
 - Baseline with nasal mask mask
 - NIOV at 100mL
 - NIOV at 180mL
 - NIOV at 250mL
 - NIV at 4cm H₂O
 - NIV at 8/4cm H₂O
 - NIV at 12/4cm H₂O
- Subjective measures recorded for mask comfort and breathing comfort

Patient Demographics

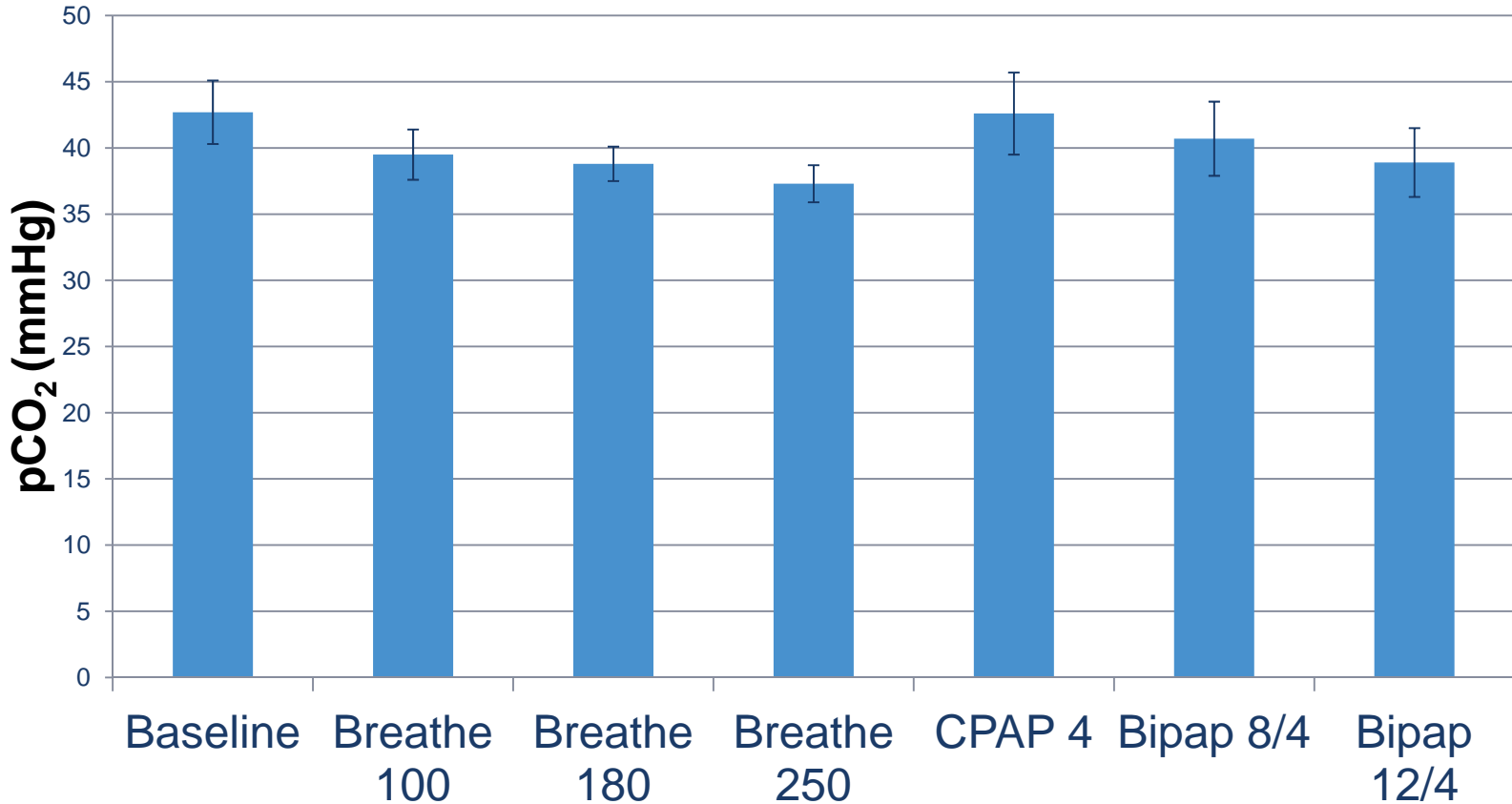
Patient	Age	Gender	FEV1	FEV1 % Predicted
1	63	Female	0.5L	23%
2	62	Male	1.62L	41%
3	54	Female	0.61L	24%
4	76	Male	1.79L	41%
5	55	Male	1.96L	35%
6	56	Male	0.84L	18%
7	64	Male	0.69L	20%
8	65	Female	0.43L	20%
AVERAGE	62	F=3, M=5	1.06L	27.8%

Results-Respiratory Rate



$F(2.590, 10.361)=6.219, p=0.013$

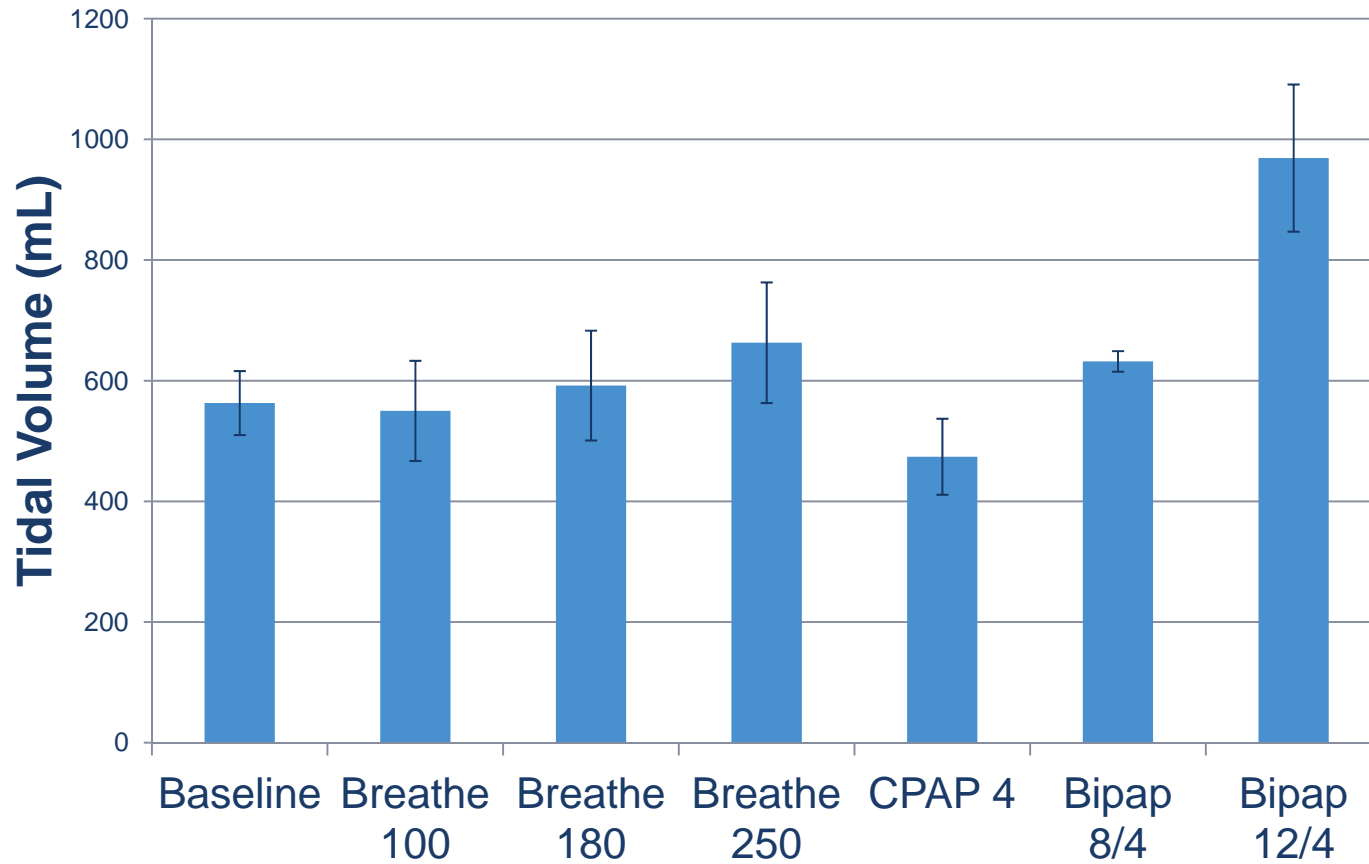
Results-paCO₂



F(1.245, 7.469), p=0.046
Baseline vs. Breathe

F(1.302, 6.683), p=0.013
Baseline versus NIV

Results-Tidal Volume



$F(2.344, 9.378)=4.631, p=0.036$

Conclusions

- Breathe NIOV system showed the following statistically significant changes:
 - Decreased RR
 - Decreased CO₂
 - Increased tidal volume

Limitations

- Despite differences in individual variables, we were unable to show a statistically significant effect on minute ventilation or trans-diaphragmatic pressure
- Subjects were evaluated at rest
 - More study is needed to determine the effect on minute ventilation and work of breathing with exercise

Acknowledgements

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