

HCA Healthcare

Scholarly Commons

TriStar Division Research Day 2023

HCA Healthcare Research Days 2023

2023

Exploring the Reduction of IPAP Below EPAP in the Therapy of Obstructive Sleep Apnea

William Noah
HCA Healthcare

Sue Lynn Myhre
HCA Healthcare, SueLynn.Myhre@HCAHealthcare.com

Follow this and additional works at: <https://scholarlycommons.hcahealthcare.com/tristar2023>



Part of the [Neurology Commons](#), and the [Sleep Medicine Commons](#)

Recommended Citation

Noah, William and Myhre, Sue Lynn, "Exploring the Reduction of IPAP Below EPAP in the Therapy of Obstructive Sleep Apnea" (2023). *TriStar Division Research Day 2023*. 3.
<https://scholarlycommons.hcahealthcare.com/tristar2023/3>

This Poster is brought to you for free and open access by the HCA Healthcare Research Days 2023 at Scholarly Commons. It has been accepted for inclusion in TriStar Division Research Day 2023 by an authorized administrator of Scholarly Commons. For more information, please contact lindsay.million@hcahealthcare.com.

Exploring the Reduction of IPAP below EPAP in the Therapy of Obstructive Sleep Apnea

William Noah, MD and Sue Lynn Myhre, PhD

Background

- Historically, continuous positive airway pressure (CPAP) device advances have been focused on reducing expiratory pressure (EPAP).
 - Beginning with Bilevel PAP (BPAP) in 1990, then expiratory pressure reduction algorithms in 2003, and later mask resistance compensation algorithms around 2010.
- The theory was that lowering EPAP would increase patient comfort because some patients complained of difficulty exhaling. However, to lower EPAP and maintain “therapy,” IPAP had to be increased.
 - Yet none of these sleep medicine armamentariums have been clearly shown to improve therapy, adherence, and safety.
- Testing IPAP less than EPAP was never well documented.
 - The philosophy behind reducing IPAP below EPAP entails optimizing pharynx cross-sectional area and viscoelastic properties and increasing end-expiratory lung volume and tracheal traction.
 - Reducing IPAP needs to be investigated.
- The V-Com™, a CPAP comfort accessory that was invented to test this theory and to lower IPAP only, was registered with the FDA June 2022.

Objective

To investigate reducing IPAP below EPAP in the therapy of obstructive sleep apnea (OSA) and to ensure it does not affect auto-titration algorithms.

Methods

Patients with excellent PAP device adherence (> 6 hours/night) and no complaints with therapy were recruited from a large, community-based sleep medicine practice to use the V-Com™ in their circuit for four nights. The V-Com™ adds a set amount of non-compensated resistance to the circuit between the PAP device and the exhaust port in the mask (1.7 cmH₂O at 50 L/min).

Pre (four nights without V-Com™) and post (with V-Com™) downloaded auto-titration algorithms (P90/95 pressure), usage time, leak and residual index data (AHI) were analyzed, summarized, and compared.

Results

Parameter	Participants	No V-Com	Std. dev	V-Com	Std. dev	Outcome w/ V-Com**	% Improved by V-Com™
P95%/90% Pressure (cmH ₂ O)	n=61	11.23	2.82	11.33	3.01	No difference	N/A-
AHI (events/hour)	n=61	2.15	2.37	1.79	1.75	Improved (p-value<0.04)	69% (n=42/61)
Leak (L/min)	n= 43*	12.06	9.50	8.00	7.27	Improved (p-value<0.0001)	88% (n=38/43)
Usage (hours)	n=61	7.27	1.33	7.54	1.43	Improved (p-value<0.03)	64% (n=39/61)

*Leak data from Reach Health/3B devices was not available. One ResMed patient had leak of 120 L/min without V-Com™ (obviously from hose disconnect or error) and was removed.

Effect of V-Com™ on P95/P90 pressure, residual AHI, leak & usage hours

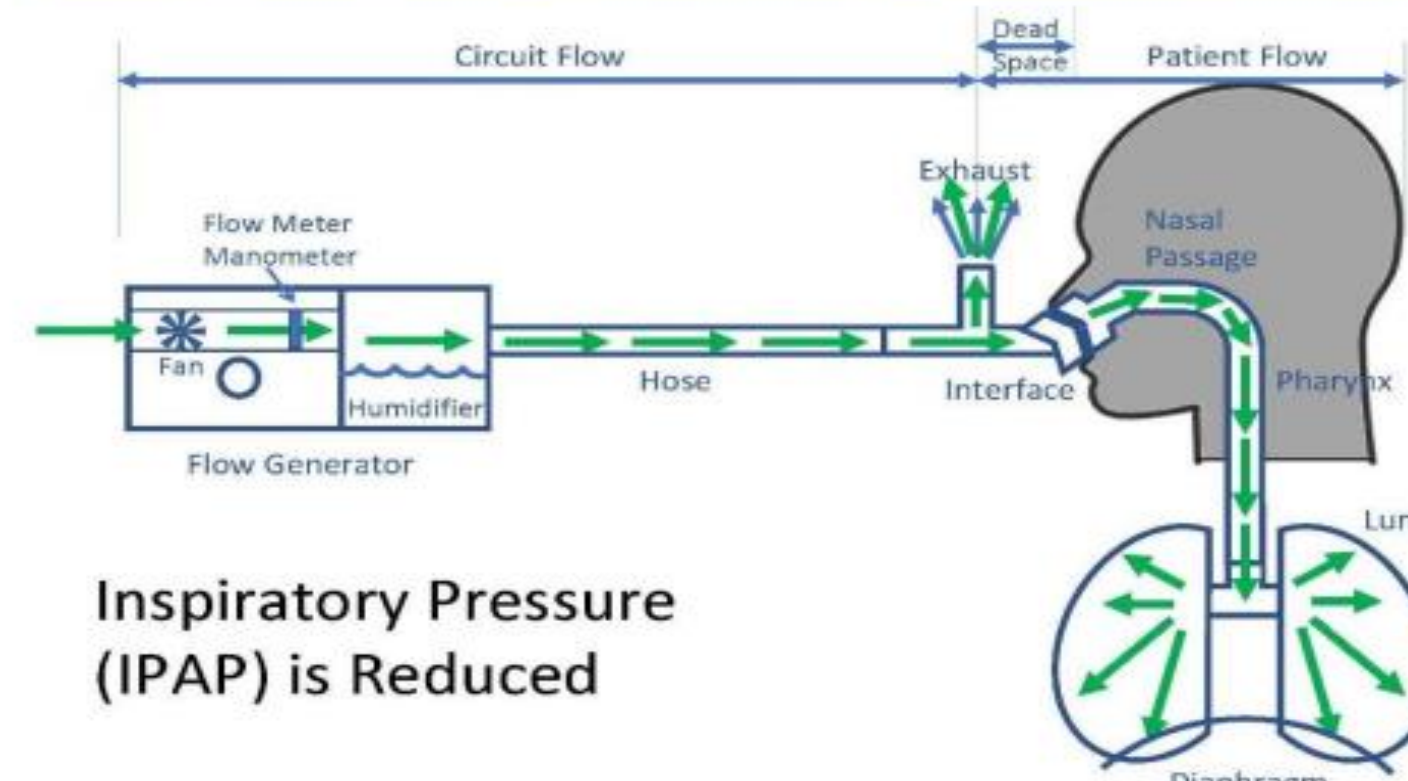
V-Com™



Launched as “Training wheels for CPAP,” but now preferred by 77% of long-term users.

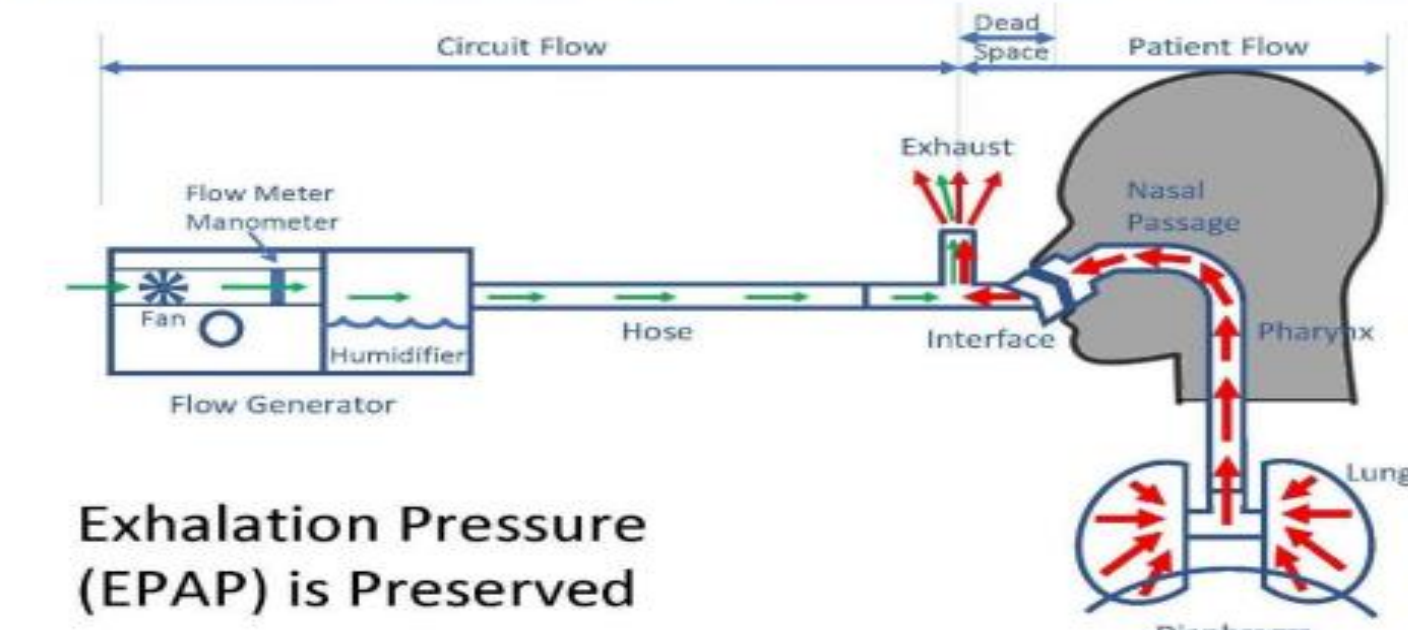
V-Com™ decreases inspiratory pressure, which allows more people to tolerate CPAP initially. It has been shown to increase usage, decrease leak, decrease residual AHI, all while maintaining P90/95%.

Inspiration: High Flow Large Pressure Drop



During the inspiratory phase on PAP, the circuit flow across the V-Com™ is high and includes the patient inspiratory flow.

Exhalation: Low Flow Minimal Pressure Drop



During expiration, there is no patient flow crossing the V-Com™ (unless there is inadequate exhaust flow and potentially rebreathing of CO₂) and much of the exhaust flow is the patient's expiratory flow so the circuit flow from the device across the V-Com™ is minimal

Discussion

- Out of 61 patients, 88% of patients demonstrated decreased leak, 69% showed a declined residual index, and 64% increased their usage with the V-Com™ in their circuit.
 - As expected, decreasing IPAP did not adversely affect therapy
 - It also suggests additional benefits of decreasing IPAP such as decreased unintentional leak and decreased residual AHI.
 - Future work should examine PAP adherence with decreased IPAP (while maintaining EPAP).
- The auto-titration algorithms (P90/95% pressure) were not significantly changed.
 - P90/95% remained the same with and without the V-Com
 - The introduction of the V-Com™ into the PAP circuit did not alter the auto titrating algorithm, as expected.

Conclusion

- Purposely adding a specific amount of non-compensated resistance to a PAP circuit is novel.
- The V-Com™ demonstrated improved therapy, including significant improvements in usage, leak, events/hour, and no difference in the P90/95% pressure.
- More evidence is needed to increase our current understanding of uncomplicated OSA and may change and improve not only the patients' and professional's choice of management, but also the sleep device industry.

References

- Strohl KP, Redline S. Nasal CPAP therapy, upper airway muscle activation, and obstructive sleep apnea. *Am Rev Respir Dis.* 1986 Sep;134(3):555-8.
- Mahadevia AK, Onal E, Lopata M. Effects of expiratory positive airway pressure on sleep-induced respiratory abnormalities in patients with hypersomnia-sleep apnea syndrome. *Am Rev Respir Dis.* 1983 Oct;128(4):708-11.
- Gugger M, Vock P. Effect of reduced expiratory pressure on pharyngeal size during nasal positive airway pressure in patients with sleep apnoea: evaluation by continuous computed tomography. *Thorax.* 1992 Oct;47(10):809-13.
- Resta O, Guido P, Picca V, et al. The role of the expiratory phase in obstructive sleep apnoea. *Respir Med.* 1999 Mar;93(3):190-5.
- Sleeper G, Rashidi M, Strohl KP, et al. Comparison of expiratory pressures generated by four different EPAP devices in a laboratory bench setting. *Sleep Med.* 2022 Aug;96:87-92.