

Bench Comparison of Non-Invasive Open Ventilation to High Flow Therapy in Various Test Scenarios

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Introduction

Non-Invasive Open Ventilation (NIOV) and High Flow Therapy (HFT) are new devices used for the treatment of patients with chronic respiratory disease. NIOV is a portable volume assist ventilation device with proprietary nasal pillows interface that uses a high pressure oxygen source to deliver volume and pressure. NIOV is designed to augment tidal volume, provide inspiratory pressure support, and increase FiO₂ to relieve dyspnea, improve oxygenation, and facilitate ambulation. HFT devices are designed to provide supplemental oxygen and add humidification for secretion clearance. HFT also flushes dead space and provides some expiratory pressure during exhalation (PEEP) using a product specific nasal cannula. Although both products can be used for similar respiratory diseases, the method of operation and objectives of therapy are different. Comparative testing to measure delivered tidal volume and peak-to-peak pressure differentials was performed with NIOV and HFT in a varying lung scenarios to determine performance differences.

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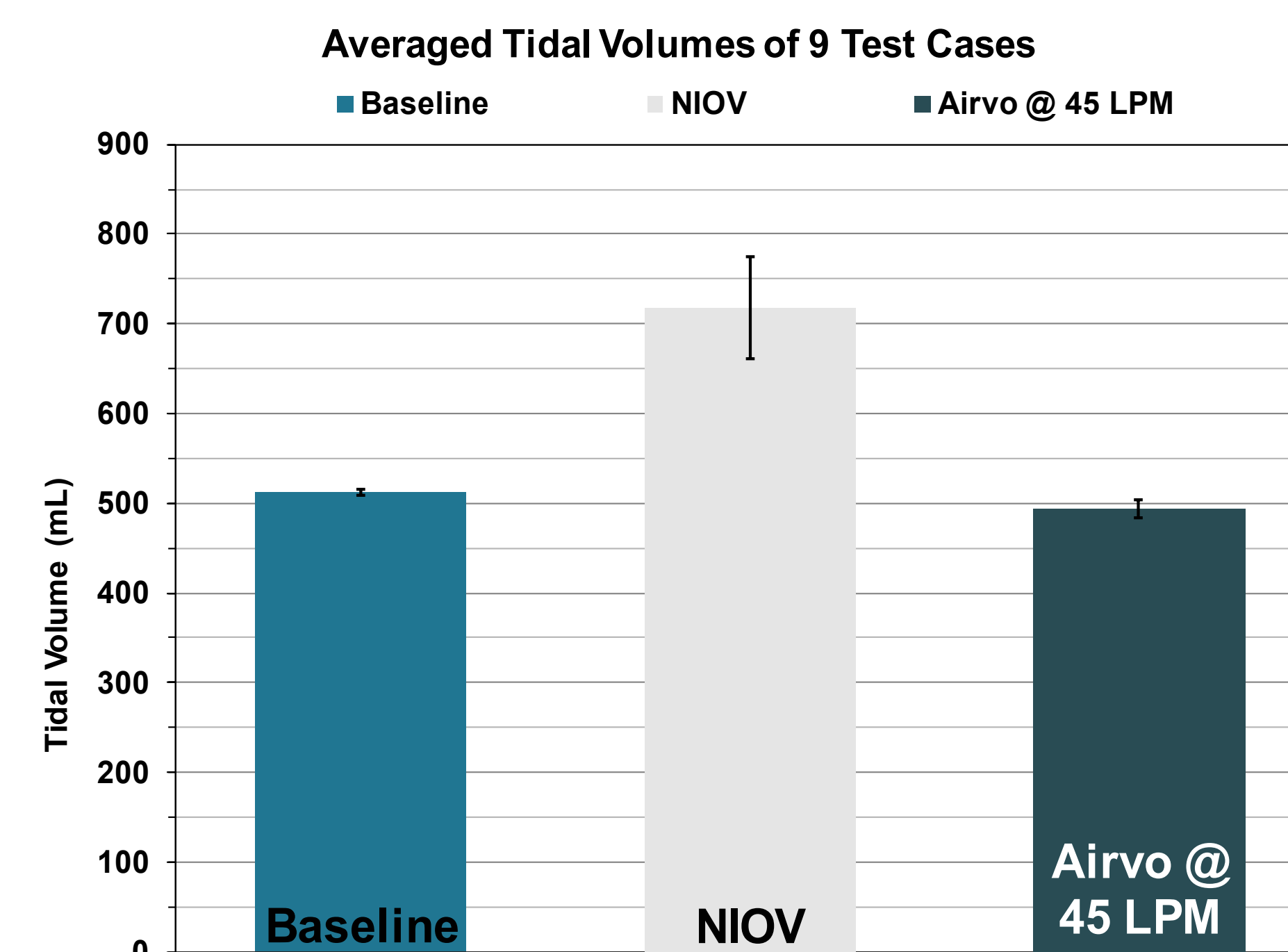
Methods and Material

A Hans Rudolph Series 1101 Breathing Simulator was equipped with a simulated nose and set to run a range of active patient conditions: Resistance 5/10/20 cmH₂O/L/s; Compliance 70/100/120 mL/cmH₂O; RR 12 BPM; with effort settings adjusted to achieve 1:2 I:E and tidal volume of 500mL for each R/C combination. A Breathe Technologies NIOV device was set to 250mL and 21% delivery time. A Fisher & Paykel Healthcare Airvo HFT system was set to the maximum 45 LPM setting. Data from NIOV and HFT performance in each patient condition was recorded by the Simulator. Recorded values included airway pressure, patient flow, volume, and effort.

Results

Tidal volumes and peak-to-peak pressure differentials on NIOV were much higher as compared to HFT. Tidal volume averages over the nine test scenarios were: Baseline: 511.6 mL ± 3.2, NIOV: 718.5 mL ± 56.9, HFT: 493.8 mL ± 9.5. Peak-to-peak pressure differentials were: Baseline- 0.3 cmH₂O ± 0.1, NIOV: 9.1 cmH₂O ± 2.0, HFT: 1.4 cmH₂O ± 0.1. Positive peak airway pressure on NIOV occurred during inhalation; positive peak airway pressure on HFT occurred during exhalation. NIOV provided inspiratory pressure support, HFT did not. HFT provided a relatively small amount of PEEP, NIOV did not.

	Tidal Volume (ml)			PTP Pressure Diff. (cmH ₂ O)		
	Baseline	NIOV	Airvo @ 45 LPM	Baseline	NIOV	Airvo @ 45 LPM
AVG	511.6	718.5	493.8	0.3	9.1	1.4
SD	3.2	56.9	9.5	0.1	2.0	0.1

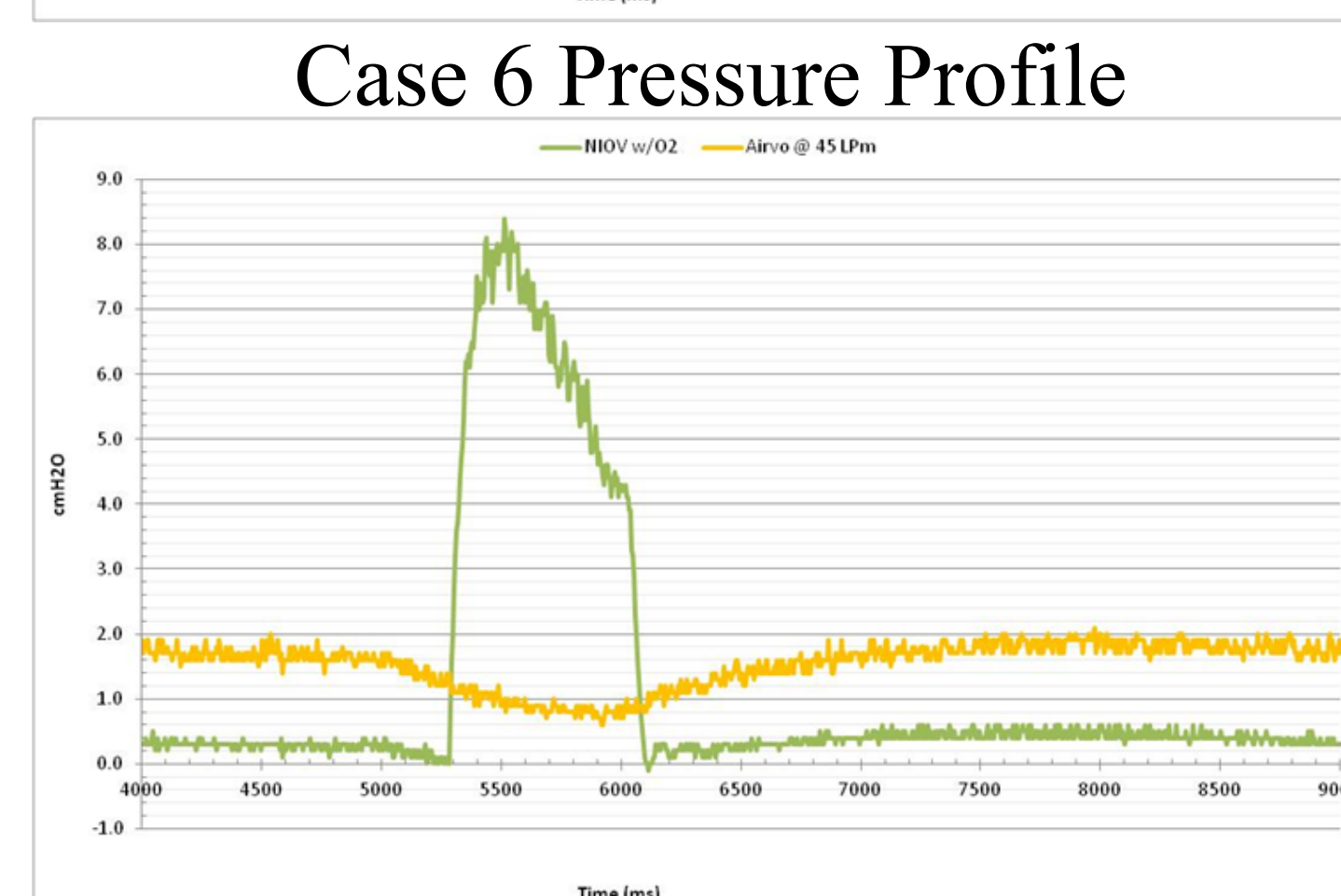
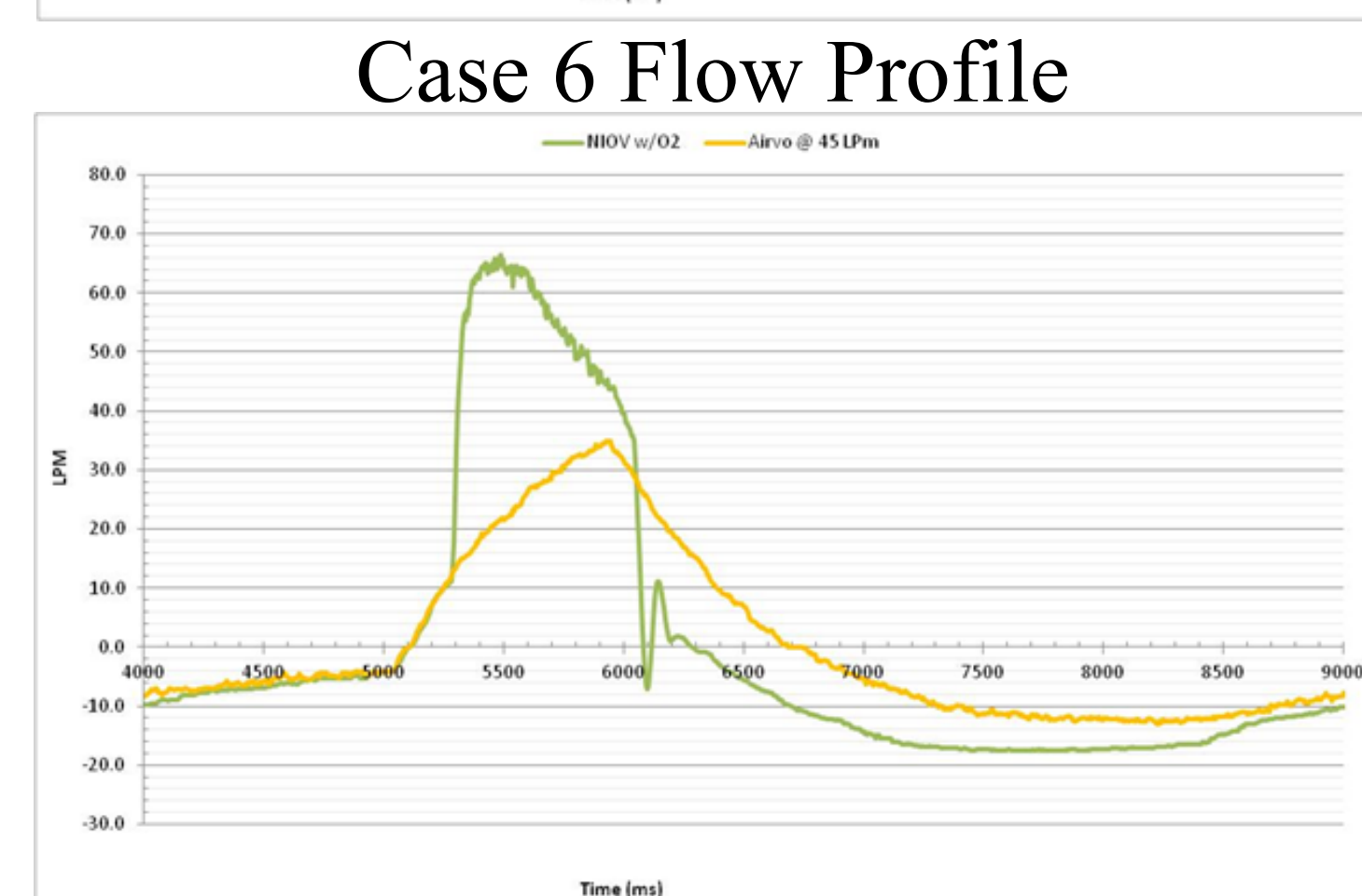
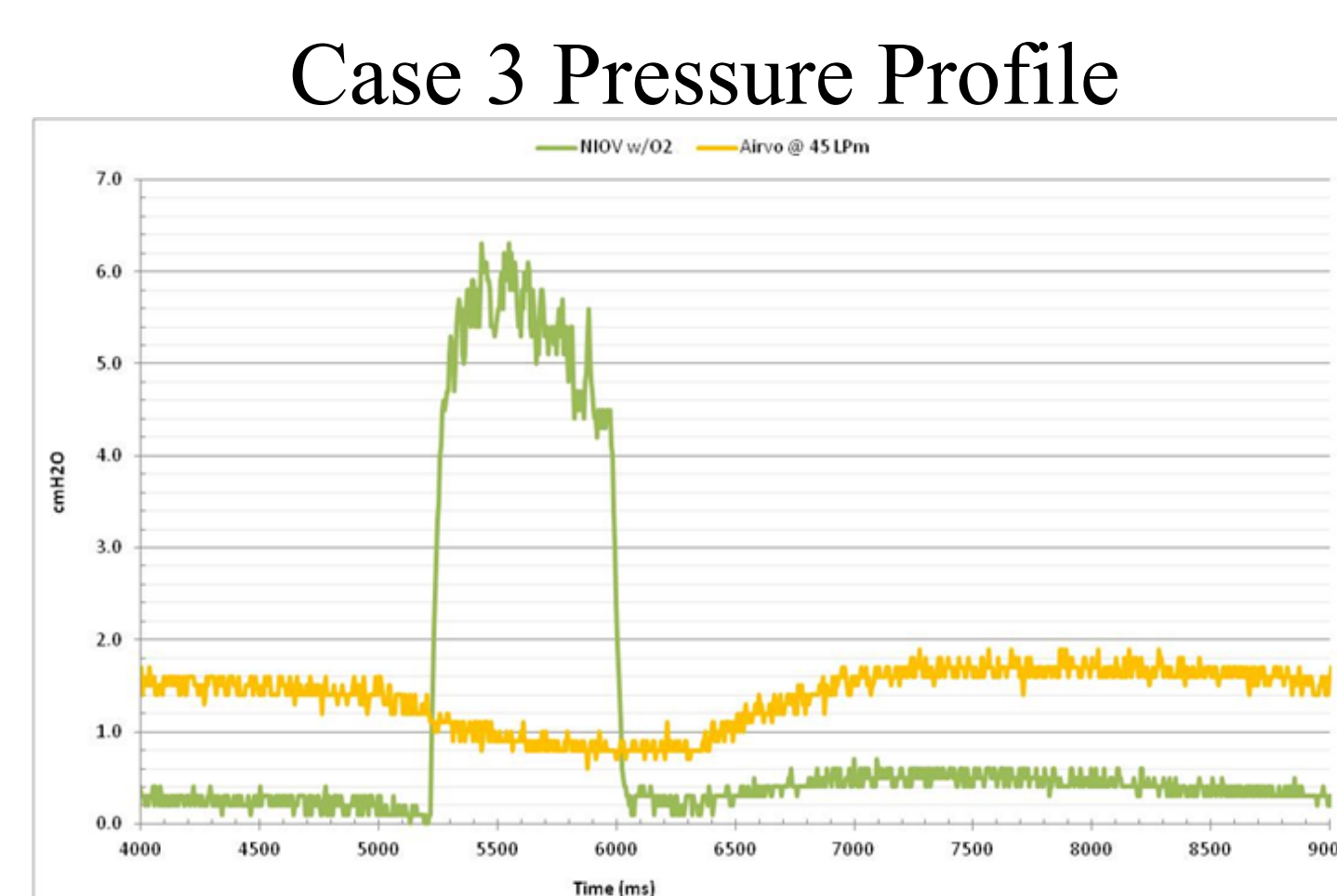
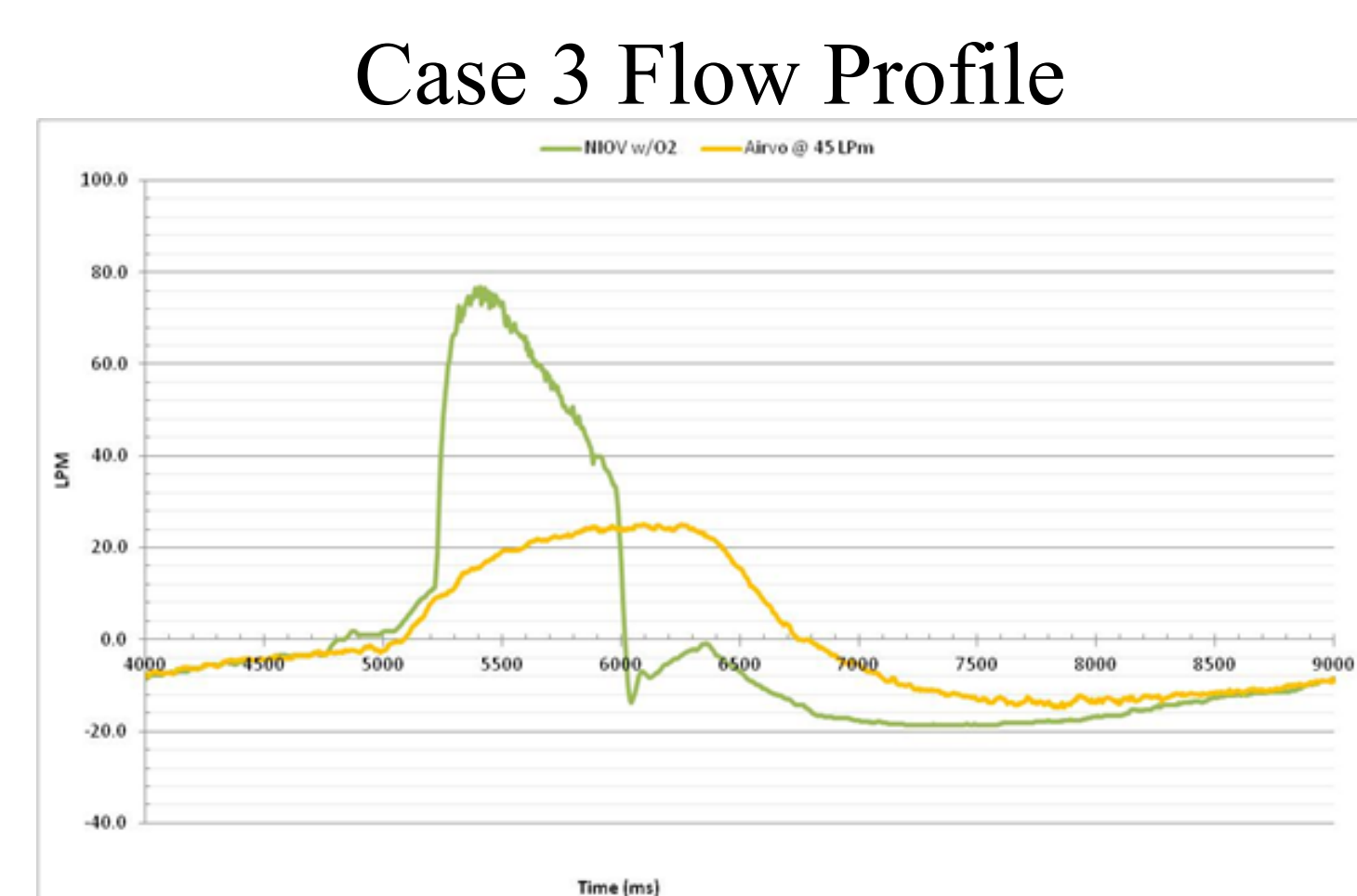


Averaged Vt:

Baseline:
511.6 ± 3.2 mL

NIOV:
718.5 ± 56.9 mL

HFT:
493.8 ± 9.5 mL

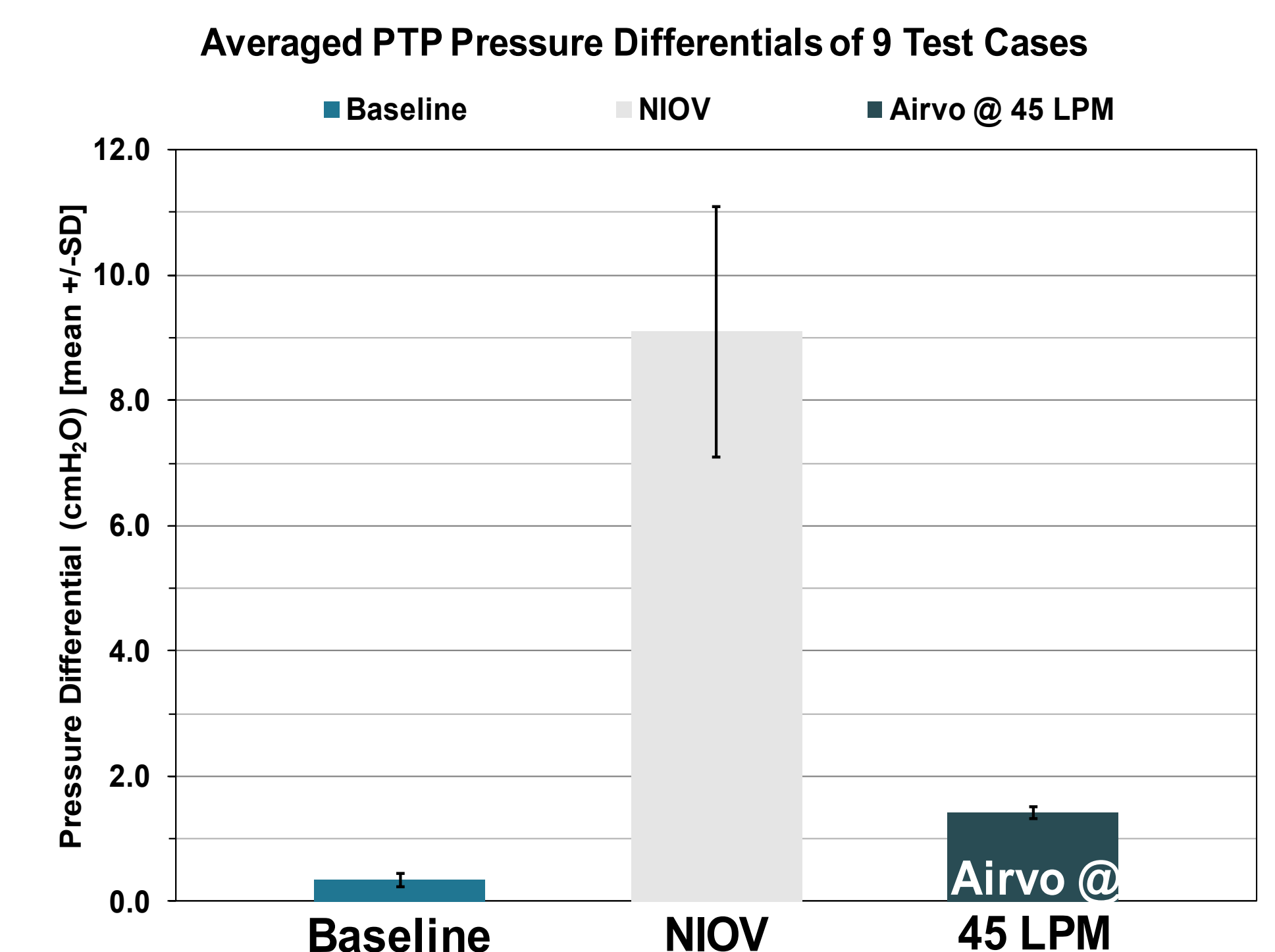


Averaged PTP Pressure Differentials:

Baseline:
0.3 ± 0.1 cmH₂O

NIOV:
9.1 ± 2.0 cmH₂O

HFT:
1.4 ± 0.1 cmH₂O



Conclusions

NIOV and HFT devices have specific capabilities and application in the treatment of patients with chronic respiratory disease. Although both products provide non-invasive oxygen and/or ambient air delivery, they are not similar in performance. Clinicians should consider objectives of therapy and be aware of the differences in performance of each device when determining the appropriate therapy for a specific patient.