

Effect of AirTrap Control function in VENTImotion 2 ventilator in ventilation of test lung with different settings of airway resistance

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Background: The AirTrap Control function in the ventilator VENTImotion 2 (Weinmann, Hamburg) reduces the respiratory frequency and the inspiration time to prevent dynamic hyperinflation under Non-Invasive Ventilation in patients exhibiting persistent late expiratory flow. **Objective:** To evaluate the ventilation quality and lung hyperinflation with and without AirTrap mode at varying degrees of obstruction in the test lung. **Methods:** Recording of pressure and flow curves with the Michigan test lung (5600i, Michigan Instruments, Grand Rapids, MI/USA) in a series of tests with increasing airway resistance levels. Analyses were made of respiratory frequency, tidal volume, minute ventilation, pre-inspiratory pressure (=PEEPi), inspiration time. **Test conditions:** respiratory frequency 20, IPAP 25 and EPAP 4 cmH₂O, outgoing Ti 35%, lung compliance 30 ml/cmH₂O). **Results:** Under the ventilator settings describe above, the AirTrap function reduced the respiratory frequency (Figure 1 A) and the inspiration time (Figure 1 B) starting at an airway resistance of 15 cmH₂O/liters/second (Figure 1, vertical dotted line). Intrinsic PEEP was first observed, however, at a resistance of 35 cmH₂O/liters/second (Figure 1 C). In the adjustment range of the AirTrap Control function, the respiratory minute volume was significantly reduced by 1.98±0.9 liters (Figures 1 D and Figure 2). The reduction of PEEPi was not statistically significant. **Conclusion:** In the test the AirTrap Control function reduced the respiratory frequency and inspiration time before PEEPi arose. As a result, there was a reduction in respiratory minute volume in a non-critical range, which would be equivalent to a CO₂ increase in vivo. The AirTrap Control function could be improved with a somewhat less sensitive or adjustable algorithm.

Figure 1 The AirTrap Control function reduced the respiratory frequency (1 A) and the inspiration time (1 B) starting at an airway resistance of 15 cmH₂O/liters/second (vertical line). Intrinsic PEEP first arose, however, at a resistance of 35 cmH₂O/liters/second (1 C). The reduction in respiratory frequency and inspiration time was accompanied by a decrease in respiratory minute volume (1 D).

Figure 2 In the adjustment range of the AirTrap Control function, the respiratory minute volume was significantly reduced by 1.98±0.9 liters.

For labels in Figures 1 and 2:

Atemfrequenz pro Minute	Respiratory frequency per minute
Intrinsicher PEEP in cmH ₂ O	Intrinsic PEEP in cmH ₂ O
Atemminutenvolumen in L	Respiratory minute volume in L
Inspirationsanteil in %	Inspiration rate in %