

Title: Tidal volume measurement during simulated high frequency oscillatory ventilation (HFOV).

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Rationale: Tidal volume (Vt) delivery during HFOV is dependent on respiratory system mechanics. To develop improved HFOV techniques, a practical measure of delivered Vt is needed across a range of clinically relevant adult HFOV settings. We assessed the validity of an ultrasound flow-meter for measuring Vt during simulated HFOV.

Method: An Eco-Physics Exhalyzer[®] D flow-meter was placed in series with a Sensor Medics 3100B HFOV ventilator and an 8.0 millimeter endotracheal tube attached to a 48.9 liter plethysmograph (compliance of 33.2 ml/cmH₂O). At a mean airway pressure of 20 cm H₂O, Vt measurements were obtained from the Eco-Physics flow-meter and compared to those calculated from pressure changes within the plethysmograph using the adiabatic gas equation. Measurements were taken for each combination of frequency (*f*: 3, 4, 6, 8, 10, 12, 15 Hz) and pressure amplitude (*P*: 30, 40, 50, 60, 70, 80 cm H₂O) using an inspiratory:expiratory ratio of 1:1.

Results: Tidal volumes measured by plethysmograph and flow-meter had a range of 32-214 cc and 29.5-220.5 cc, respectively. By Bland-Altman analysis, the mean difference in Vt was -2.7 % (95% limits of agreement: -16.15, 10.75 % difference). Four of the 42 potential *f*:*P* combinations fell outside the detection limits of the flow-meter and were not included in the analysis (10 Hz/30cm H₂O, 12 Hz/30cm H₂O, 15 Hz/ 30cm H₂O, and 15 Hz/40 cm H₂O).

Conclusions: The Eco-Physics Exhalyzer[®] D provides a reliable estimate of Vt during adult HFOV with a Sensor Medics 3100B ventilator between 3-12 Hz and *P* of 40-80 cm H₂O.

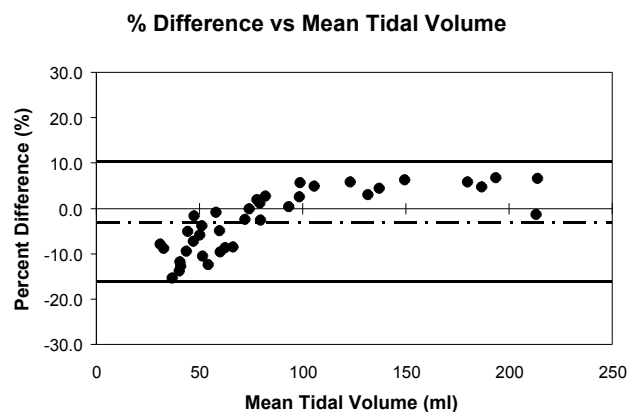


Figure 1

