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Work of Breathing using NIOV in a Low Compliance High Minute Ventilation Lung Model

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Background: The Non-Invasive Open Ventilation system (NIOV, Breathe Technologies Inc.) is a ventilation assist device that utilizes a nasal pillow interface. We measured work of breathing (WOB) changes during breathing simulation in a low compliance high minute ventilation lung model using the NIOV system.

Method: The ASL 5000 breathing simulator was attached to model noses and set to a frequency of 30/min with the constant tidal volume closed loop control of Pmus, set point Vt 500 mL, rise time 20%, inspiratory hold 0%, release time 20%, resistance 10 cm H2O/L/sec, and compliance settings 20, 30, 40, and 50 mL/cm H2O (C20, C30, C40, C50). The NIOV device was set to an inspiratory time of 30%, trigger sensitivity 3, and low, medium, and high volume settings of 50, 150, and 250 mL (V50, V150, V250). ASL 5000 measurements were used to calculate total patient WOB in Joules/Liter (J/L) at each test condition. Baseline WOB measurements without NIOV were recorded with a nose model alone (B1) and with a nose model with the NIOV nasal pillows permanently attached (B2). All measurements were recorded during each test condition after the ASL 5000 closed loop control of Pmus stabilized at the set point Vt of 500 mL.

Results: Patient WOB increases with the application of the NIOV nasal pillow interface (B2-B1) by an average of 0.26 J/L (range 0.19 - 0.31 J/L). NIOV settings of V50, V150 and V250 decreased WOB from baseline B2 by an average of 5% (range 4 - 7%), 33% (range 28 - 38%), and 70% (range 56 - 81%). The average peak inspiratory pressure (cmH2O) with NIOV was 0.2 ± 0.3 (range 0.0 – 0.7), 5.5 ± 0.6 (range 4.7 – 6.5), and 13.3 ± 0.5 (range 13.0 – 14.1) at the V50, V150, and V250 settings respectively.

Conclusion: These results suggest that NIOV may be useful as a ventilation assist device to reduce WOB in patients with low lung compliance and high minute ventilation requirements.

