Monitoring of ventilation in premature infants is challenging, especially as current strategies seek to minimize duration of intubation. A monitor that could provide continuous, non-invasive measurements of respiratory volumes in intubated and non-intubated neonates can help track the effectiveness of therapeutic interventions and optimize care. A novel non-invasive, continuous Respiratory Volume Monitor (RVM) that calculates MV, TV from thoracic biomechanics measurements was adapted for use on neonates. The objectives of the study are to develop and test a calibration algorithm for an RVM system (modified ExSpiron, Respiratory Motion, Inc., Waltham MA) based on TV & RR simultaneously measured by a flowmeter (NeoFlow, Drager Medical, Inc. Telford, PA) to assess RVM TV in positive pressure ventilator breaths at different pressures & in negative pressure spontaneous breaths. To evaluate the RVM in neonates after extubation and following the administration of opioids and stimulants to measure trends in MV, TV, and RR.

Methods

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Results

RVM respiratory flow curves were compared to flowmeter respiratory curves, yielding correlations between 0.89-0.96 (Figure 2). Preliminary analyses of the subgroup, showed decrease in TV & MV (-45±21%, -41±10%) after morphine in 1 baby & an increase in TV & MV (+85±46%, +107±42%) after caffeine in 2 babies (Figure 3A, middle and bottom). There was a decrease in TV & MV (-30±8%, -35±4%) after extubation (Figure 3A, top) followed by an increase to substantially above pre-extubation baseline (+65±22%, +111±20%) within an hour in 3 babies who remained extubated (Figure 3B, left) and a continuing decrease in TV & MV (-65%, -54%) in the 1 baby who was reintubated (Figure 3B, middle). One baby given caffeine just prior to extubation showed an increase in TV & MV (+37%, +50%) after extubation and further increase (+53%, +58%) an hour later (Figure 3B, right).

Conclusions

The RVM has the capability to quantitate the effects of interventions and potentially drive decisions regarding medications and airway management. Follow-up studies to evaluate the effect of interventions such as administration of stimulants or opioids, as well as monitoring respiratory trends post-extubation, are ongoing.