**SIMVENT: a Patient Simulator to Test Mechanical Ventilators and to Train Residents**


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**Background:** Patient simulators for ventilators usually are passive devices consisting of rubber balloons, springs and tubes. In all simulators reviewed, except one, the ventilator under test (VUT) provides energy: simulation is thus limited to passive resistance/compliance with no sham spontaneous breathing to trigger pressure support ventilation (PSV).

**Objective:** We designed a simulator (SIMVENT) which materializes the lung equation. It is capable of testing PSV operation. SIMVENT evaluates commercial ventilators as VUTs. We connected SIMVENT to our ventilation training software.

**Method:** SIMVENT includes a 2 litre cylinder with a step-motor powered piston, a 2 litre cylinder mimicking residual volume, sensors for “alveolar” and “airway” pressure, a step-motor compressed tubing to simulate variable airway resistance, a microcontroller and a computer interface. SIMVENT acts as a patient under ventilation with programmed airway resistances and lung compliance. SIMVENT displays parameter curves and values to be compared with those shown by the VUT. Spontaneous inspiration attempts are created by SIMVENT to test VUT performance: the user selects the breathing attempt pressure drop (5 cmH2O e.g.) and if it is to be generated either at random or respiratory cycle locked. A report is generated for each VUT.

**Results:** Four ventilators were tested in Pressure Control, Volume Control and PSV modes. Tidal volume differed up to 15% (2nd generation analogue VUT: 28%). Airway pressure was within 8%. Respiratory frequency displayed by VUTs coincided with SIMVENT measurements, except a 4% difference with the analogue VUT.

**Conclusions:** SIMVENT costs one order of magnitude less than existing active testing devices. It proved useful to test VUTs as well as to compare their ability to detect and support spontaneous breathing during patient partial respiratory support. For the first time ventilators can be fully evaluated prior to clinical use.