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Title: A non-invasive LPG (long-period grating) fiber-optic sensing method for respiratory volume monitoring

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Body: Background: In the NIV setting, the monitoring of respiratory function is essential. Since leaks around the mask are inevitable, ventilators give only an estimate of Vt (tidal volume) and MV (minute volume); blood gas assessment is regarded “gold standard” monitoring of respiratory function, usually taken at 1 and 4 hours after NIV start. Observation of chest expansion is recommended for monitoring in real time, a clearly indirect and only subjective assessment of respiratory function. Aims: To assess quality of LPG sensors measurements of tidal and minute volumes in healthy volunteers, and evaluate the hypothesis that respiratory volumes are proportional to torso curvature measured at one torso point. Methods: Silicon rubber encapsulated LPG sensor patches were used for volume measurements. A self-adhesive sensor (1.4x6cm) was attached to subject's lower ribs. All measurements lasted 60 sec, with subjects in supine position and an ultrasound type spirometer used as a gold standard reference. Results: Measurements were done in 21 healthy volunteers (10 female, 11 male). In 1 minute quiet breathing (Vt: 539±102 ml), LPG sensor to spirometer difference in MV was 6.45±4.51% (0.65±0.49 L/min), and difference in Vt was 9.55±3.92% (56±26 ml). Conclusions: LPG sensors provide a promising tool for measuring Vt and MV in real time with good accuracy, independent of mask air leaks. This will enable monitoring of ventilation parameters in NIV that will improve ventilator setting, and thus reduce morbidity and need for intubation.