BACKGROUND
Spontaneous breathing during mechanical ventilation requires a big deal of synchronization between patient and ventilator. Literature indicates that the degree of synchronization in majority of ventilated patients is not optimal. Mismatch between the patient and the ventilator can lead to many deleterious effects, such as increased patient’s work of breathing, prolongation of ventilation time, and ICU length of stay. Studies have shown that expiratory dys-synchrony is the rule not the exception. Expiratory synchrony refers to the degree of matching between patient’s breath ending and cease of flow from the ventilator. Most commercially available ventilators use expiratory flow as a signal to start expiratory phase. In such design, a user-selected flow level is set so that expiration ends once that set level is reached. User-selected expiratory trigger level may not adapt to the ever-changing patient’s ventilatory demand. The Newport E360 ventilator has introduced a patented feature (FlexCycle®) by which the expiratory threshold is automatically selected based on a built-in mathematical model. The earlier version of this feature in the Newport E500 ventilator was compared to a 5% expiratory threshold in Servo 300 ventilator and found to provide better expiratory synchrony.

Study Objective:
To compare the performance of Fixed vs. Automatic expiratory trigger the Newport E360 ventilator under different simulated clinical conditions using variations of the followings variables:
- a. Pressure Support Levels.
- b. Patient’s demands.
- c. Airway Resistance.
- d. Lung Compliance.

METHODS
We used Active Servo Lung simulator (ASL5000) to simulate breathing conditions. ASL5000 is capable of initiating spontaneous breaths, and allows different settings of breathing profile. Lung Simulator was connected to Newport E360 ventilator. Twenty breaths were recorded for each settings and 5 consecutive breaths were analyzed for expiratory delay time (EDT).

Experimental Setup

RESULTS
Effect of Changes in PS Level and Patient Effort:

Effect of Changes in Resistance & Compliance:

MAIN FINDINGS
1. Increases in PS level generally led to late breath termination.
2. Increases in patients effort (Pmus) induced early breath termination.
3. Higher Resistance induced late breath termination.
4. Low lung compliance induced early breath termination.
5. Fixed ETS performed slightly better than Auto ETS at low Pmus.
6. At medium and high Pmus, Fixed and Auto ETS performances were comparable.
7. Performance of Fixed and Auto ETS as a response to changes in lung mechanics were comparable.

CONCLUSIONS
1. It seems that expiratory synchrony is affected by the delicate balance between patient’s effort and set PS level.
2. Auto ETS performed at least as good as Fixed ETS but was not superior to Fixed ETS.
3. Auto ETS may not be suitable for patients with low breathing efforts.
4. Higher PS is known to provide better trigger synchrony due to high initial flow, but has adverse effects on Expiratory synchrony.
5. Interplay of PS level, degree of patients’ effort, compliance and resistance should be taken into consideration when evaluating patient-ventilator synchrony.
6. Although this study revealed the inter-relationship effects of PS level, Pmus, C, and R on expiratory synchrony, results of this bench study should not be extrapolated as such to clinical practice.

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