Asynchronies using a simulator of artificial ventilation (SimVA) in virtual COPD patients, effects of reducing pressure support or increasing expiratory trigger.

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Simulation in intensive care is an innovative method for teaching. Respiratory settings can be responsible for some asynchronies, which may increase mortality of our patients (1). For this reason we develop a simulator of spontaneous artificial ventilation (SimVA) and virtual breathing patients. Mathematical model resolved differential equations of chest and lung movements according to inspiratory effort in order to match with a clinical database. The goal of this study was to evaluate asynchrony index (AI) in virtual COPD patients according to pressure support (PS) level and Inspiratory time (Ti) and to compare the results to the study of Thille et al (2).

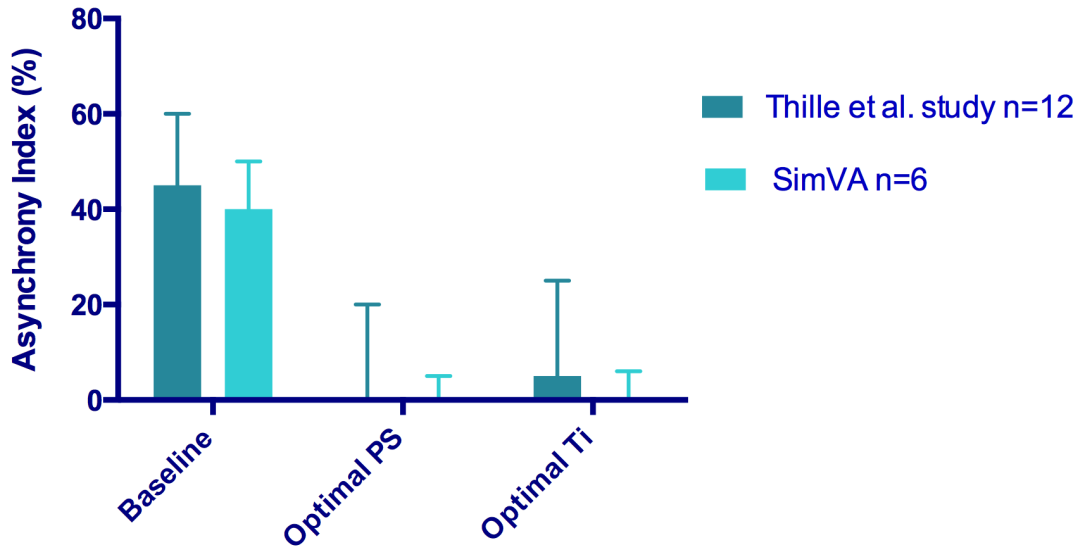
***Method*:** Virtual case were COPD, defined by thoracic and pulmonar compliance, total resistance, lung volumes, and inspiratory adaptive muscle pressure. Asynchrony Index was patient ineffective efforts (IE)/ (IE +Ventilator Respiratory Rate). Ventilatory protocols were Baseline-PS, Optimal-PS and Optimal-Ti (Optimal meant decreasing PS or Ti in order to reduce AI) as described by Thille et al (2). Each virtual case was titrated with each protocol. AI was recorded and compared to the results of Thille et al.

Results:

Protocols	**Baseline PS**		**Optimal PS**		**Optimal Ti**	
Patients	**Real**	**Virtual**	**Real**	**Virtual**	**Real**	**Virtual**
V_T ml.kg^{-1} PBW	10,2 [7,2-11,5]	10,0[8,0-11,2]	5,9[4,9-6,7]	6,3[5,5-7,0]	7,0[5,9-7,9]	6,1[6,1-6,7]
PS cmH_20	20[19,5-20]	19,5[19,0-20,0]	13[12-14]	13,0[12,7-14,0]	20[19,5-20]	19[19-19,5]
PEEP cmH_20	5[5-5]	5[5-5]	5[5-5]	5[5-5]	5[5-5]	5[5-5]
RR ventilator breaths/min	16,1[12,4-17,2]	12,5[11,0-15]	22,4[22,0-31,3]	20,0[18,0-22,5]	22,6[20,1-30,1]	18,0[15,7-19,3]
RR patient breaths/min	26,6[23,1-31,9]	19,5[18,5-22,0]	29,4[24,6-34,5]	20,0[18,0-22,5]	28,3[23,3-34,3]	18[17,7-19,3]
Vm L/min	8,5[7,8-9,9]	10,5[8,1-14,0]	9,4[8,4-11,1]	9,3[8,4-10,7]	9,8[7,8-11,4]	9,7[8,7-10,2]
% Expiratory Trigger (%)	25[25-25]	25[25-25]	25[25-25]	25[25-25]		50[45-52]

Real patients n=12, Virtual patients n=5

The optimal protocols titrated PS or Ti in order to reduce AI, the software simulates the corresponding values of tidal volume and respiratory frequency and its effect on intrinsic PEEP and gas trapping. The difference in settings and respiratory mechanic between virtual cases and patients were not significant (Table and Figure 1).



***Discussion*:** AI was able to change according to PS or Ti settings within the same range as the study from Thille et al. Simulation with the software SimVA is realistic and may help to teach interactively ventilatory settings and asynchronies in COPD patients under Pressure Support Ventilation anywhere without any risk for the patient.

1. *Intensive Care Med. 2015;41:633-41.*
2. *Intensive Care Med. 2008;34:14773-1486.*