Conclusion

The ALOSI is an active lung and obstruction simulator with an obstructive element. In combination with a standardized test sequence and relevant performance indicators it is possible at first time to test and compare the overall performance of respirators.

Features

- ❑ Active and passive lung simulation
- ❑ Reproduction of respiratory flows and events
- ❑ Free definition of flow- and obstructive patterns
- ❑ Free definition of lung parameters and obstructions within human based physical limits

Applications

- ❑ Standardized performance benchmark of respirators
- ❑ Repeatable test of any respirator
- ❑ Comparison of respirators
- ❑ Test of new developed respirator controllers
- ❑ Quality control and quality assurance
- ❑ Analysis of mask systems

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ALOSI

Characteristics

Features

Opportunities

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Active Lung and Obstruction SImulator

From the idea to the product

Neither hardware nor software exist up to now to validate existing and new developed controllers for respirators that treat the obstructive sleep apnea (OSA). Furthermore there are no standardized criteria to compare respirators in a repeatable way. For prescribing medicals but also health insurance companies it is nearly impossible to select the right respirator for a successful therapy with appropriate costs.

The Active Lung and Obstruction Simulator ALOSI

The **A**ctive **L**ung and **O**bstruction **SI**mulator ALOSI has been developed based on these needs.

The starting point is the computer simulation of the human lung with free definition of the upper airway obstruction.

The interface of the lung simulator with the obstructive element (OE) is done via USB and a DA/AD-converter. The respirator that has to be checked must be connected to the lung model.

Using the ALOSI it is possible to physically simulate the time varying obstruction of the upper airways during a free defined human respiration within physiological ranges. Therewith it is possible to simulate normal breathing, obstructive, central and mixed apneas, Cheyne-Stokes-Respiration, snoring and leakages. Consequently a detailed investigation in the control strategy of the respirator is now possible.

Performance indicators and test sequence for respirators

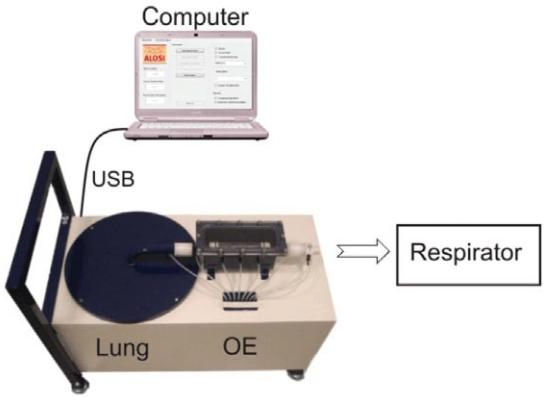
Up to now there were no standardized performance indicators to fully describe the characteristics of respirators. Now they have been developed in close co-operation with experienced sleep medicals.

Five performance indicators have been defined to describe the “steady state accuracy” and the “dynamics after respiratory events”.

The performance indicators are calculated as quotient of the current value and the defined value of the physical quantity. In an optimal case (current value = defined value) they are equal 1. A respiratior has to be technically optimized the more the performance indicator deviates from this optimum.

Different test sequences have been developed to determine the performance indicators for respirators. Within these sequences which vary between 60 and 83 minutes different degrees of obstruction with varied duration, central apneas, snorings and leakages are simulated. Data capture is done with the connected computer, who also calculates the performance.

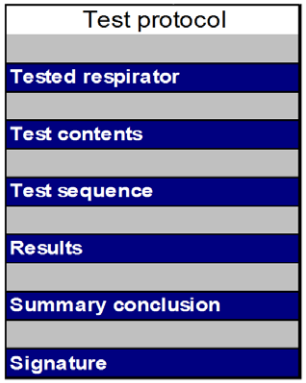
The results are clearly represented in a standardized protocol, abnormalities are depicted and a summary conclusion is provided.



ALOSI

Performance Indicator	Name	Deviation effect
G	*Pressure accuracy*	*- comparison of different respirators not possible* *- complicated exchange to other respirator* *-distress*
K	*Pressure stability*	*- anticyclic pressure supply* *- increased respiration work* *- increase of early obstructions*
$D_{an/ab}$	*Controller dynamics*	*- to slow therapy of OSA* *- symptoms and consequences of OSA* *- improved respiration work* *- increased mean respiration pressure*
F	*Air supply*	*- oxygen over- or undersupply*
T	*Dead time*	*- to late/to long OSA-therapy*

Performance indicators for evaluation of APAP-respirators



Standardized test protocol