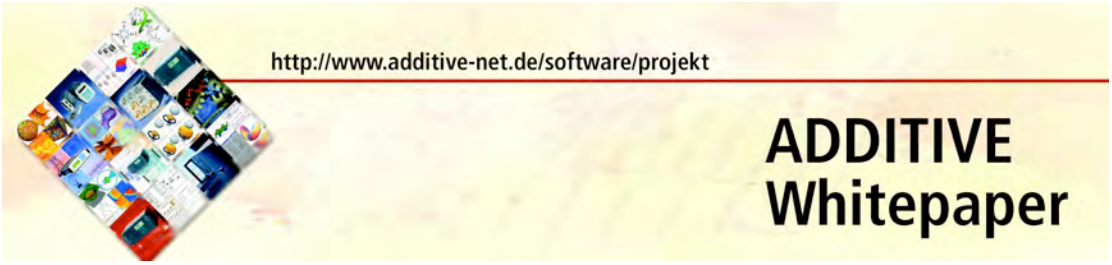

Experiments Increase Understanding of Chronic Obstructive Lung Disease

Ausgangssituation
Um Erkenntnisse über das Atemverhalten von Asthmatikerin und Patienten chronischen Atembeschwerden zu sammeln, wurden Messungen durchgeführt, in denen das Atmen mit verschiedenen Techniken untersucht wurde.

Fragestellung
Gemessen wurden Atemstrom, Luftdruck und damit verbundenes Lungenvolumen, Kraft der eingesetzten Muskeln, CO2-Gehalt in der Atemluft, CO2-Gehalt im Blut, Sauerstoffsättigung des Bluts. Die verschiedenen Messdaten werden während des Experiments in Echtzeit ausgewertet.

Lösung
Nach dem Einlesen der verschiedenen Daten über einen Analog-Digital-Konverter, werden die Daten in ein gemeinsames Origin Worksheet eingelesen, analysiert und visualisiert, der Vorteil von Origin ist, dass es heterogene Daten verwalten und analysieren kann. werden.

Autor:
Bengt Kayser,
M.D., Ph.D.,
Research Fellow McGill
University Montreal,
Quebec

McGill University researchers have gained a better understanding of chronic obstructive lung disease through experiments that induce pulmonary hyperinflation in healthy subjects. The experiments showed that the discomfort experienced by sufferers of this disease is largely due to their inability to empty the lungs during expiration which increases the effort required for inspiration. The next step is attempting to develop new breathing techniques and exercises to strengthen the upper body in an effort to reduce breathing difficulties. A key to the success of these experiments was the use of a new Windows-based data acquisition and analysis package which made it possible for researchers to immediately begin viewing, plotting and analyzing data while the experiment was still being run. A key obstacle which had to be overcome in these experiments was that actual chronic obstructive lung disease patients could not be used as subjects because of the risk to their health. Instead, a starling resistor was used on the expiratory leg of the respiratory circuit to induce pulmonary hyperinflation in normal healthy subjects. The starling resistor was set to limit flow to a maximum of one liter per second. When the subject reached a certain level of exertion, the flow limitation forced them to utilize higher lung volumes. This effect is comparable to what would happen in a person suffering from chronic obstructive pulmonary disease or asthma when ventilatory demand increases, for example, during exercise.

The experiments demonstrated that discomfort experienced by lung disease sufferers is closely related to an increase in end-expiratory lung volume. The volume increase is caused by their inability to empty their lungs because of the limitation on expiratory flow. This was demonstrated by the fact that the exercise limitations experienced by the healthy subjects were linearly related to the amplitude of the pressure difference from expiration to inspiration. Some progress was also made in training the healthy subjects in alternate breathing techniques that allowed them to increase their exercise performance under the flow limitations set by the starling resistor. Extensive instrumentation was required to monitor the breathing patterns of the subjects of these experiments. A pneumotachograph was attached to a mouthpiece to measure the air flow. This device measures the pressure drop over a honeycomb grid, making it possible to calculate the airflow in and out of the lungs. A pressure transducer was also attached to the mouthpiece. The subjects were also asked to swallow two small latex balloons to measure pressure in different areas of the respiratory tract. One balloon was oriented in the esophagus and the other in the stomach of the subject. Two pairs of magnetometers, one at the level of the sternum and the other at the level of the navel, were used to measure chest wall displacement. These measurements provide reference of differential respiratory muscle use. The concentration of CO2 in the exhaled air was measured by continuously drawing a small sample of gas and feeding it to an electronic composition analyzer. Finally, the amount of oxygen in the blood was measured through the infrared absorption method. An infrared sensor was applied to a finger or ear of the subject to measure the amount of light that was absorbed, making it possible to calculate the percentage of hemoglobin in the bloodstream that was saturated with oxygen.

McGill researchers wanted to perform these experiments in order to be able to monitor subjects under a wide range of exercise conditions. They wanted to be able to acquire and analyze data on a laptop computer so that they would not be restricted to exercises which could be performed in their laboratory. They obtained a National Instruments DAQ 700 card, one of the first analog-to-digital converter cards made in the form of a Type 2 PC card that fits most laptop computers. This card was installed in an IBM Thinkpad Model 750 CS which is an 80486 system running at 33 MHz with 12 MB RAM. When this experiment first began, data acquisition was performed with MS-DOS-based data acquisition software.

The main problem with this software was that it did not contain data acquisition capabilities and generated data files in a proprietary binary format. This meant that each file had to be converted to the ASCII format before it could be imported into a separate data analysis package for analysis. This process, which took about an hour, could not even be started until all of the experimental data was acquired. One other problem with this package was that the file size that it could handle was limited meaning that it could not handle high sampling rates or long sampling periods.

Researchers examined another popular data acquisition and analysis system that supported the DAQ 700 card but found that the learning curve to master it was quite steep. Then, the McGill researchers heard about a software package that provides extensive acquisition and analysis capabilities combined in a single system and was only a fraction of the cost of the other program. This package, called ORIGIN, offers real-time analysis and acquisition so that researchers can examine their data while the experiments are being run and perform analysis and plotting without exporting or importing data or even loading up another software package.

OriginLab, Corp., Northampton, Massachusetts, is the developer of ORIGIN. ORIGIN includes a user interface module that provides interface elements for data acquisition development. A real time module provides graphic objects for the visualization and manipulation of data in real time. Simple applications can be built merely by dragging icons onto ORIGIN's worksheet. The program provides 20 icons that handle virtually any data acquisition operation without the need for programming or even for entering commands. For example, one button handles the interface to the DAQ system. The icon's parameters are set by double-clicking and editing the settings in dialog boxes. The user simply drags the desired icon, sets a few points such as frequency and packet size, and data acquisition is ready to run. While the program used in the past relied on exporting files to a separate data analysis program, ORIGIN is recognized as one of the leading scientific data analysis and technical graphics software. This makes it possible for the complete acquisition, analysis and plotting solution to be built in a single software environment. ORIGIN's powerful mathematical and statistical operations include smoothing, regression, integration/differentiation, FFT, t-test, ANOVA and curve fitting. The program supports a wide array of 2D and 3D graph types and allows graphs to be edited simply by double clicking on plot elements.

McGill researchers quickly developed a data acquisition system in which the seven channels of data mentioned above scroll across the screen and are written into a worksheet. Having all the signals scrolling quickly alerts the researchers if a wire comes loose or some other problem occurs, so that they can stop the experiment and fix the problem. McGill researchers also wrote several simple scripts that perform real time analysis tasks that are impossible with a multiple software solution. For example, McGill researchers wrote a two-line script that calculates a moving average of data at 10 second intervals and displays it on the screen. The ability to acquire and analyze data and generate graphics from within a single software package helped to researchers collect and analyze the data in far less time than would have been required using the previous software.

Kontakt
Gerne beraten wir Sie zu Ihrer individuellen Projektlösung, rufen Sie uns an unter
Tel.: 06172-5905-30 oder kontaktieren Sie uns per E-Mail unter solutions@additive-net.de
Weitere Informationen zu Origin: http://www.additive-origin.de/
E-Mail: origin@additive-net.de