



# WAKING UP TO BETTER POLYSOMNOGRAPHY

*By Stephanie Richardson*

When “Grey’s Anatomy” star Justin Chambers checked into Los Angeles’ UCLA Medical Center last January, he hadn’t slept for weeks. By the time doctors diagnosed his insomnia, Chambers admitted to going through a two-month span where he got about one solid hour of rest each week.

“I suffer from a biological sleep disorder,” Chambers told *People* magazine in March 2008. “Your body is tired but your mind keeps racing. You lie down and then you get up and pace, and then you lie down but you can’t fall asleep.”

In the past few years, celebrities have taken their sleep battles public to boost awareness of the serious health effects of conditions such as obstructive sleep apnea, insomnia and narcolepsy. Rosie O’Donnell and William Shatner are just a couple of advocates for OSA.

Unfortunately, with all of the education about sleep disorders, diagnostic methods have received far less media attention. It’s often the diagnostic part of the medical process that makes older patients uncomfortable and frightens younger ones. With input from patients and sleep physicians, developers of polysomnography and other sleep diagnostics are creating devices that are easier to use and less intrusive, and that provide more accurate and reliable results.

### ***In the sleep lab***

Streamlined and wireless are just two words to describe state-of-the-art polysomnography. With in-lab PSG continuing to be the gold standard in sleep diagnostics, sleep technologists seek devices that are intuitive, accurate and patient-friendly. Manufacturers have been apt to respond with big solutions in small packages.

More and more of today’s sleep diagnostics are billed as complete turnkey solutions, including all of the hardware, software and sensors required for a successful study. The pre-installed software usually comes with all working configurations for montages, scoring modules and reports for routine protocols such as standard PSG, CPAP/bi-level, split night and multiple sleep latency test. Commonly, these PSG units range from 16 to 64 input channels.

As computer networks become more prevalent in hospital communities, PSG developers are integrating standard network interfaces that are compatible with most desktop computers. This means that the modern sleep lab can take full advantage of a hospital’s high-speed computer network. Integrated TCP/IP architecture permits sleep technologists to control and monitor amplifiers in the laboratory from any computer in the network.

Additionally, some amplifiers can stream data directly to an acquisition computer located in rooms adjacent to patients or as far as the network reaches. This eliminates a need for custom cables and wiring.

For those sleep technologists and patients not wanting to be tied down, several PSG systems now come with wireless connections. Like their wired counterparts, wireless PSG units can connect directly to a network using LAN technology. One available system can roam among three different access points without losing a signal. The unit’s LDC display shows operational status for battery, transmission, reception, and impedance check results. The same operational data is available remotely via the network viewing system.

While some wireless systems require a desktop, other units for the sleep lab are handheld. They, too, provide a seamless transition between ethernet/USB, wireless and compact flash cards for data transfer and storage. Most of these systems provide up to 24 hours or recording time when operating at a full charge.

It’s important to note that for both standard and wireless PSG systems, video components have become an important part of remote monitoring. Video allows sleep technologists to see and hear a patient’s movements and sounds as they are synchronized with test results. This aids in clarifying difficult diagnostic decisions.

### ***On the home front***

In March 2008, the Centers for Medicare and Medicaid Services (CMS) released a new policy, which permits Medicare beneficiaries to undergo diagnoses for obstructive sleep apnea using a home sleep test. Last year, CMS also changed its national coverage determination to include Type II, III and IV devices for home sleep testing.

Manufacturers continue to develop home sleep screeners because they are a valuable tool for testing patients. They are most likely to be offered to patients with a high pre-test probability of moderate to severe obstructive sleep apnea with no other comorbid medical conditions.

One of the latest home sleep monitors is a lightweight Type III device with six channels. For up to 12 hours, it can record a patient’s airflow, snoring, blood oxygen saturation, pulse rate, body position and effort - all known indicators of sleep disorders.

Setup for this and other home tests is not daunting. After minimal hook-up, the user goes to sleep. The next day, the

## Featured

## PSG Devices



Alice PDx Diagnostic System  
Philips Respironics  
724-387-5200  
[www.philips.com/respironics](http://www.philips.com/respironics)  
Circle Reader Action# 53



EasyNet® System  
Cadwell Laboratories, Inc.  
800-245-3001  
[www.cadwell.com](http://www.cadwell.com)  
Circle Reader Action# 54



Cap One End Tidal CO<sub>2</sub>  
Nihon Kohden America  
800-325-0283  
[www.nkusa.com](http://www.nkusa.com)  
Circle Reader Action# 55

### Polysomnography...continued from page 62

patient can take the device to a certified sleep lab where a sleep tech will review the data and print a comprehensive report.

Another Type III home monitor provides nine channels, exceeding CMS and American Academy of Sleep Medicine requirements for portable monitoring. Handheld and wireless, it increases a patient's comfort by eliminating long lengths of wire that can tangle during sleep and impair mobility. Patient data is saved to a removable memory card for later retrieval.

Both patients and sleep professionals were taken into consideration when the following Type III device went under development. For patients, the sensor hook-up is simplified and easy to use, although it still incorporates accepted PSG sensor technology. For sleep technologists, the device collects data typically associated with Type IV devices such as finger probes and flow for testing. It also autoscores data for quick reporting or gives an option to review waveforms epoch-by-epoch in a full-featured scoring mode.

A different kind of sleep screener uses only respiratory airflow detected by a nasal cannula to detect apneic events. The unit clips to a patient's clothing or rests on his or her pillow. When breathing decreases by 50 percent or more for at least 10 seconds, the device records an apneic event on its readout. In the morning, the device shows all recorded events, and the patient can call them into his or her physician or sleep lab.

Any sleep technologist can see that there is a wide variety of diagnostic equipment available. With a little bit of research, sleep technologists and physicians can select the diagnostic systems that best suits the needs of their practice and patients.

Stephanie Richardson is a freelance medical writer in Philadelphia.

### Pulmonary Diffusion...continued from page 31

Normal carbon monoxide saturation or carboxyhemoglobin percent is  $\leq 1$ , but smokers can have a level as high as 10. Involvement in a traffic jam can result in levels up to 7. The half-life of carboxyhemoglobin is five to six hours while breathing room air and is one to two hours breathing 100 percent oxygen.

Carbon monoxide binds very strongly to the iron atoms in hemoglobin, the principal oxygen-carrying compound in blood. The affinity between CO and hemoglobin is 200 times stronger than the affinity between hemoglobin and oxygen. When CO binds to the hemoglobin, it cannot be released nearly as readily as oxygen would be. The preferential binding of carbon monoxide to heme iron is the main reason for carbon monoxide poisoning.

The decrease in diffusion with a carboxyhemoglobin above 1 percent results from the fact that there is less available hemoglobin for oxygen attachment. It has been found that diffusion decreases about 1 percent for each 1 percent increase in carbon monoxide saturation. A commonly used correction factor is supplied by the following equation:

$$AdjHb = DLCO \frac{(1 + \%COHb)}{100}$$

I noted above that the capillary transit time is approximately 0.7 seconds, and that the oxygen equilibrium time in the capillary is approximately 0.2 to 0.3 seconds. During periods of increased cardiac output, the difference between these two times allows for the proper transfer of oxygen. If the cardiac output was increased three-fold, then the capillary transit time would equal the oxygen equilibrium time. Further increases in cardiac output would result in incomplete equilibration, but that would be more than offset by the additional transport capacity of the increased blood flow.

Diffusion is slightly increased in healthy subjects and that is demonstrated by the slight increase in PaO<sub>2</sub> found after maximum exercise. There are additional factors to consider with exercise, including recruitment of alveoli and the general dynamic effects of increased cardiac output and minute ventilation.

Any technologist performing a diffusion capacity test will appreciate the importance of proper lung inflation in order to obtain the most accurate results. Significant alveolar inflation introduces enough test gas into the alveoli so that effective gas transfer can occur. The American Thoracic Society recommends that during the single breath diffusion maneuver, the patient should be instructed to inspire the test gas to a vital capacity which is at least 85 percent of a previous measured slow or forced vital capacity. Diffusion capacity increases in a linear fashion with increased inspired vital capacity, as well as with increased alveolar volume.

Diffusion capacity is often referred to as an indirect measurement of the condition of the alveolar capillary membrane. In reality, the test produces results that accurately reflect the condition of the membrane, as well as other related physiological factors such as hemoglobin and carboxyhemoglobin. The test has been checked for its significance through many collaborating studies. If testing devices are properly calibrated, and if standard laboratory subjects are regularly tested for proper quality assurance, then the test results can play an important and significant part in pulmonary diagnostics.

Jim Harvey MS, RPFT, RCP works in the Pulmonary Function Laboratory at Stanford Hospital and Clinics in Palo Alto, and teaches Pulmonary Function at Skyline College in San Bruno, California.