Technological Advances in the Clinical Management of Obstructive Sleep Apnea

By Tom Smalling PhD, RRT, RPSGT, RPFT, FAARC and Russell Rozensky BS, RRT, RPSGT

Obstructive Sleep Apnea Syndrome (OSAS) is a common condition affecting an estimated 2–4% of Americans. Although OSAS is a known risk factor for a number of diseases, including cardiovascular disease, it is underdiagnosed and often dismissed as harmless snoring. Positive airway pressure (PAP) continues to be the gold standard for treatment of OSAS. In recent years, a wide range of PAP devices and interfaces has become available to enable respiratory and sleep specialists to better diagnose and treat OSAS. These include devices that allow the clinician to deliver continuous positive airway pressure (CPAP) either automatically or by manual titration. The Standards of Practice Committee of the American Academy of Sleep Medicine (AASM) have established an eight-point list of recommendations to establish the proper use of automatic PAP devices, which offer the advantage of patient self-use. Other options for treatment include somnoplasty and the use of oral appliances and dental devices. In this module of Clinical Foundations, two experts in sleep medicine review the recent advances in the diagnosis and treatment of OSAS, including data acquisition and management, evaluation of efficacy with respiratory inductance plethysmography, and the proper use of interface devices. Despite the clinical success observed with these innovations, evidence-based analysis and basic research is needed to ensure reliability and validity.

Roundtable: Improving Patient Compliance with (C)PAP Therapy

Moderator: John Basile, BS, RRT
Panelists: Diana Guth, BA, RRT
Reggie Binns, RPSGT
Suzanne Bollig RRT, RPSGT, R.EEG.T

Ensuring compliance with CPAP therapy can be a challenge. Many patients may find it inconvenient or bothersome to use their PAP device for the prescribed number of hours each night, and yet the importance of regular use cannot be overemphasized. In this roundtable discussion, four experts discuss the meaning of compliance and what might be regarded as “acceptable” compliance, the critical role of patient education, and how some of the new technologies and interface devices have improved compliance with CPAP therapy.
Technological Advances in the Clinical Management of Obstructive Sleep Apnea

By Tom Smalling PhD, RRT, RPSGT, RPFT, FAARC and Russell Rozensky BS, RRT, RPSGT

O
f the more than 80 sleep disorders classified by the International Classification of Sleep Disorders (ICSD), Obstructive Sleep Apnea Syndrome (OSAS) is perhaps the most ubiquitous. OSAS is either a partial or total obstruction of the airway that usually leads to oxygen desaturation and fragmentation of sleep. Although the true prevalence of OSAS is unknown, the Healthy Sleep website (ResMed) estimates that 2-4% of the US population is affected, with only 20% being diagnosed. This low rate of diagnosis may mark a lack of appreciation of the medical significance of OSAS. For example, many adults are familiar with snoring and think of it more as an annoyance than a medical problem. But how many actually report snoring to a physician? Conversely, how many clinicians ask their patients about snoring, morning headaches, nocturesis, night sweats, and daytime sleepiness? Many clinicians still do not perform a sleep history on patients with undiagnosed OSAS as well as those at risk for developing OSAS. The clinical significance of misdiagnosis is underscored by growing evidence linking OSAS with an increased risk for obesity, diabetes, hypertension, coronary artery disease, stroke, congestive heart failure, gastric esophageal reflux disease (GERD), and other physical and psychological disorders. While many individuals with OSAS still go undiagnosed, growing awareness of its importance together with a responsive medical equipment industry has led to rapid and significant advances in the technological management of OSAS. This article describes a number of these technological advances and suggests how they have impacted the clinical management of this disease.

Technological Advances using Positive Airway Pressure

Positive airway pressure (PAP) is the primary treatment for patients with OSAS. PAP acts as an “air splint” to keep the upper airway open and to eliminate snoring. PAP is a therapy that requires no alteration to the patient’s anatomy (such as surgery), is non-invasive, and can easily be tested for efficacy in a sleep center. The technologist or therapist applies a PAP interface to the patient, and while the patient is asleep, titrates the pressure to eliminate obstructive apneas, hypopneas, snoring, and arousals. With a properly performed PAP titration, the patient should demonstrate increased slow wave sleep and increased REM sleep, which could indicate that the PAP was at or near a therapeutic level. The current standard of practice is to titrate PAP during full polysomnography (PSG) to obtain a fixed single airway pressure which the patient subsequently uses nightly. Continuous positive airway pressure (CPAP) is a “set” pressure that stays consistent throughout the respiratory cycle. Most patients will tolerate CPAP therapy, but some may not. They may have difficulty tolerating the higher pressures or may need less pressure when they sleep on their side as opposed to the supine position. For these patients, auto-titrating devices may be more efficacious.

Automatic Titration

Recently, devices that automatically titrate pressure levels have become available. Such devices continually adjust pressure as needed, to maintain airway patency. These adjustments can be made with or without the intervention of a technologist. Data obtained during automatic positive airway pressure (aPAP) titration can be used to provide a fixed single pressure for subsequent treatment. Alternatively, aPAP devices can be used in self-adjusting mode for treatment. There are also aPAP devices that adjust airway pressures slightly above and below therapeutic pressures. One such device, the C-Flex™ (Respirronics, Murrysville, Penn.) (figure 1), adjusts the airway pressure slightly using comfort settings from 1 to 3. The patients are able to adjust the pressure to fit their needs, which may lead to increased compliance and better outcomes.

The Standards of Practice Committee of the American Academy of Sleep Medicine (AASM) formed a task force to establish practice parameters for the appropriate use of aPAP. After a review of the literature, their recommendations were as follows:

1) A diagnosis of OSAS must be established by an acceptable method.
2) APAP titration and aPAP treatment are not currently recommended for patients with congestive heart failure, significant lung disease (e.g., chronic obstructive pulmonary disease), daytime hypoxemia and respiratory failure from any cause, or prominent nocturnal desaturation other than from OSAS (e.g., obesity hypoventilation syndrome). In addition, patients who do not snore (either naturally or due to palate surgery) should not be titrated with an aPAP device that relies on vibration or sound in the device’s algorithm.
3) APAP devices are not currently recommended for split-night studies because none of the reviewed research studies examined this issue.
4) For treatment of OSAS, certain aPAP devices may be used during attended titration to identify (by polysomnography) a single pressure for use with standard CPAP.
5) Once an initial attended CPAP or aPAP titration has been successfully determined with polysomnography, certain aPAP devices may be used in the self-adjusting mode for unattended treatment by OSAS patients.
6) Procedures for the correct use of unattended aPAP — either for the

Figure 1. C Flex ™(Respirronics, Murrysville, PA)
initial determination of pressures for fixed CPAP or for self-adjusting aPAP treatment in CPAP-naïve patients — is not yet currently established and thus unattended aPAP is not recommended.
7) Patients treated with fixed CPAP on the basis of aPAP titration or those treated with aPAP must be followed to determine treatment effectiveness and safety.
8) Re-evaluation and, if necessary, standard attended CPAP titration should be performed if symptoms do not resolve or the CPAP or aPAP treatment otherwise appears to lack efficacy.

Further studies are needed to determine (1) the effectiveness of aPAP in mild OSAS, (2) the safety and efficacy of initial titration of aPAP in CPAP-naïve patients in an unattended setting, and (3) whether chronic treatment with aPAP can increase patient acceptance and adherence to positive pressure treatment. While there are increasing numbers of studies comparing different aPAP devices, there is a dearth of evidence regarding outcomes of unattended aPAP in at-risk patient groups. For those diagnosed with OSAS who cannot tolerate PAP titration, technological advances in the field of sleep medicine have resulted in a number of other treatment options.

**Somnoplasty**
A relatively new treatment called somnoplasty has been developed to address the problem of snoring (i.e., excessive vibration of the soft palate and uvula during sleep). Somnoplasty uses low-power, low-temperature radiofrequency energy to create finely controlled coagulative lesions (i.e., clots) in the mucosa of the soft palate, uvula, and tongue. These lesions are eventually resorbed over several months, causing stiffening of the palate and a reduction of tissue volume, which in turn leads to resolution of snoring. Patients should be followed with a repeat polysomnogram to evaluate the effectiveness of the treatment. Ideally, the procedure should reduce or even eliminate the patient’s snoring and sleep disordered breathing (SDB).

Somnoplasty is performed under local anesthesia in an outpatient setting and takes an average of 30 minutes. Unlike laser procedures, somnoplasty is essentially painless and minimal recovery is required. After the procedure, swelling of the posterior pharynx will often cause a temporary paradoxical increase in distance from one side of the jaw to the other. As the upper jaw expands, the lower jaw will expand outward also. Over time, the expansion will allow the airway to become more rounded, thus allowing for more laminar airflow, decreasing overall air speed with inspiration and exhalation, and decreasing the possibility of snoring or upper airway collapse.

**Improvements in Existing Data Acquisition Technologies**
As technology advances at an ever-accelerating rate, so does the ability to integrate these improvements into devices that improve the diagnosis and treatment of OSAS. Sleep diagnostic systems are quite complex in their design and continue to improve, particularly in the following areas:

**Remote Access**
Remote access of sleep acquisition systems, including respiratory inductance plethysmography (RIP), is very useful for tracking purposes. This can include patient demographics such as zip codes, primary referring physician, insurance companies, age, and gender. Databases are also useful to track reimbursement from the insurance companies (and to negotiate better payments for services rendered), open accounts, and bad debts.

Video archiving is very useful for recording seizures, codes, and incidents related to patients. It is also very useful for recording patient and staff safety practices for liability issues. Most patients do not know what they do at night, and may be oblivious to such behavior as sleep walking, sleep talking, and acting out dreams in REM Behavior Disorder (RBD). If such an incident occurs, having a record of the entire PSG, including video, is very useful in litigation.
evaluating airflow limitation. RIP allows the clinician to better diagnose upper airway resistance syndrome (UARS). In some systems, RIP uses a calibrated signal that is analogous to flow. Piezo crystal belts measure the effort of the patient at the point of the crystal sensor. The sensor area can be 1 to 5 inches long, which is a small distance when compared to the chest size of the average male patient seen in a sleep center. A RIP belt has a thin wire the entire length of the belt and measures the expansion of the thoracic or abdominal wall. This provides a more accurate measurement of effort than the piezo crystal belts. The basic theory is that as a person goes from exhalation to inhalation back to exhalation, the length of the belts change. Since the belts are roughly circular, a change of area for that circular region can be calculated. That change of area (volume with 2 belts) can be compared to time and a flow wave form can be generated (Volume/time = flow, in L/min).

**PAP Devices and Interface Equipment**

Because RIP is a critical first line treatment for OSAS, PAP devices and interfaces should have different features for acute and home care settings. In an acute care facility, the PAP device should be quiet, small, and allow the technologist to remotely adjust RIP pressures in the control room. It should enable the technologist to evaluate RIP level, respiratory rate, tidal volume, and air flow. The PAP unit should also be able to be switched from CPAP to bilevel as needed.

For the home setting, the PAP device should produce a compliance report that contains data (such as start and stop times of the therapy, disconnects during the night), and have the ability to generate numbers and graphs that can be easily evaluated by the physician. The eCompliance System® (DeVilbiss, Longmont, Colo.) uses the Internet to deliver data on patient use of PAP equipment. This compliance monitoring system allows physicians to track multiple PAP patients on a daily basis from the physician’s office. Smart card technologies allow a detailed breakdown of PAP use by the patient in the home setting.

The data can be retrieved at the physician’s office and reviewed. The data can also be broken down by daily start time, interruptions, and end time. A review of the data can reveal if the patient is using the PAP device later on weekends, indicating a potential sleep debt requiring further evaluation and treatment.

The interface is the most crucial component of the system. If the interface too small, too tight, or causes pressure sores, the patient will not use it. It is important to select an interface that is appropriate for the patient. Interfaces come in a variety of sizes and types including nasal pillows and nasal, full-face, and oral masks, and a variety of materials such as gel, vinyl, and cushioned. However, the suitability of an interface for a particular patient population should be considered. For example, patients who are obligatory mouth breathers or occasional mouth leakers have traditionally used full-face masks or nasal masks with a chin strap. Both of these options have traditionally been undesirable because of the tendency for leaks and the uncomfortable nature of a ‘full-face’ solution. A dual-airway interface (Hybrid™, Teleflex Medical, Durham, NC) consisting of an oral cushion that covers the mouth and two nasal pillows that fit into the patient’s nostrils can address the needs of this patient population.

**Conclusions**

The clinical management of OSAS has experienced unparalleled advances in new research, integration into medical specialties, and new and improved technologies. PAP continues to be the first line treatment and the suitability of an interface is the most crucial component of the system. Advances in interface technology can help address the needs of special patient populations. Oral devices are shown to be effective in patients with OSAS, but at this stage it is not possible to predict which patients can be treated successfully. APAP units have been shown to reduce costs when used for airway pressure titration in patients with severe OSAS. In the surgical field, the most valuable development has been tissue reduction using radiofrequency energy (somnoplasty), a minimally invasive procedure which has been shown to be effective. Mandibular positioning devices and rapid mandibular expansion have been proven recently in a significant proportion of patients with varying disease severity. All these developments necessitate comprehensive, evidence-based analysis and review of applied, clinical and basic research to ensure reliability and validity.

**References**


**Thomas R. Smalling, PhD, RRT, RPFT, RPSGT, is Clinical Assistant Professor in the Department of Respiratory Care at Stony Brook University. Professor Smalling serves nationally as the Chair of the AARC Speciality Section in Sleep. He is also a board member on the Committee on Accreditation of Respiratory Care (CoARC). As the AARC representative on the CoARC committee, he works primarily on accreditation standards for polysomnography. Professor Smalling is also an editorial board member for several journals. He has served on several committees on the Board of Registered Polysomnographic Technologists (BRPT) and the Association for Polysomnographic Technologists (APT).**

**Russell E. Rozensky, BS, RRT, CPFT, RPSGT is a full-time faculty member in the Respiratory Care Program at Stony Brook University. He has been involved in his profession as a member of the Board of Directors for the New York State Society for Respiratory Care Southeastern Chapter. Mr. Rozensky is also involved as a site visitor for the Committee on Accreditation of Respiratory Care, specializing in Polysomnography accreditation. Mr. Rozensky has written numerous articles for professional journals. He is a nationally-recognized speaker in the area of sleep technology.**
Roundtable: Improving Patient Compliance with (C)PAP Therapy

Moderator: John Basile BS, RRT,
Panelists: Diana Guth BA, RRT
Reggie Binns RPSGT
Suzanne Bollig RRT, RPSGT, R. EEG.T

Basile: The subject of patient compliance with PAP therapy is on the minds of everyone involved in sleep medicine. It is a subject that has been studied extensively by many different groups and yet we struggle with putting their findings into practice. We hope during this roundtable discussion to bring to light answers to many of the questions you may be asking in regard to this subject.

What is the compliance rate we are aiming for? How should it be measured?

Guth: In order to answer both these questions, the goals of treatment need to be defined first. Simply put, the goal of compliance is to provide restorative sleep by maintaining a patent airway and prevent the ill effects of untreated OSA. This improves the patient’s quality of life because they feel well rested, mentally alert and energetic. This is usually accomplished by having the patient sleep with a continuous positive airway pressure (CPAP) or bilevel positive airway pressure (Bilevel PAP) device; this is the gold standard for the treatment of obstructive sleep apnea (OSA). In order to answer the first question one must define “compliance.” The most direct answer would be that the patient uses PAP whenever they sleep; that is, all night long and whenever they nap. The patients benefit most when they sleep with the device all night long, every night. We are aiming for 100% compliance. This is a lofty goal that isn’t possible or realistic but it is the appropriate goal.

Measurement should be associated with the goals of treatment. One of the most important goals is for the patient to feel better. Pre and post Epworth Sleepiness Scale tests can be administered in order to translate the subjective data into objective data. An additional subjective test that the patient’s sleep partner answers is also significant. Physiologically relevant measurements can be tracked if the patient comes into treatment being hypertensive. Some patients suffering from depression secondary to OSA are able to go off antidepressants. Many PAP devices have the capacity to record the number of hours the patient has slept per night. The added cost/compliance benefit from this feature along with the labor of the download/assessment needs to be weighed.

Binns: Concerning compliance, of course we would like to see 100%, however realistic numbers should be somewhere around 90% to 95%. There are many mechanisms to measure compliance, including subjective reports given by the patient, vigilance questionnaires, and now information provided by the CPAP equipment which can be downloaded to a computer for review.

Bollig: Most of the literature states that a minimum of four hours of PAP therapy each night for at least five nights a week is necessary to derive significant benefit. With that said, most clinicians will agree that any use is better than none and most likely the patient will derive maximum benefit if PAP therapy is used throughout the night, every night. Subjective reports of PAP therapy use often do not correlate well with objective measures of compliance, though most currently available equipment comes with a meter to track hours-of-use. I believe that the patient should be encouraged to utilize the therapy as much as possible, but, in addition to hours of use, an important aspect of successful therapy is the resolution or attenuation of the patient’s presenting signs and symptoms of OSA.

What is the role of patient education in PAP therapy and how should this education be administered? By whom?

Guth: Education should be part of the continuum of care. Each healthcare provider involved in the diagnosis and treatment of OSA should explain to the patient or family what they can anticipate, interpret the test results for them, and follow-up on the treatment. This includes the physician who refers the patient for a sleep study, the sleep medicine physician, the prescribing physician (who may be the referring or sleep medicine physician), the sleep lab personnel who arrange for the sleep study, the polysomnograph technician and perhaps most important of all, the respiratory therapist who actually provides the treatment.

Binns: I agree with Ms. Guth; heated humidification and pressure relief have improved compliance significantly. These modalities may not be for every patient, however; for those that need extra relief in pressure, it has been a blessing to have access to a device with this capacity rather than using a BiPAP, which drives up the cost for both the insurance company and the patient. Since PAP devices are portable and may be carried when travelling, it is my belief that heated humidification should be included in every device and should be utilized at the patient’s discretion. With regards to pressure relief, it also should be included in every device. Many patients treated with higher pressures initially do well, however over time they may become intolerant to higher PAP pressures and may require pressure relief.

Binns: The role of patient education is very important. The patient needs to understand their pathology and how the PAP device corrects the problem. Without this education, there is a large knowledge gap which the patient may fall into, leading to non-compliance in the use of the device. As Ms. Guth mentioned, education regarding PAP devices should be the responsibility of a few different people including the sleep disorders technician and consulting sleep physician, and the technologist or therapist who administers the device.

Bollig: In my experience, patient and family education is one of the key influences on long-term compliance. Patients may feel overwhelmed at the idea of committing to a potentially long-term, daily treatment. Their understanding of the disease process along with the benefits and risks of treatment or non-treatment may aid in the acceptance of PAP therapy. The education process ideally begins with the physician during the initial patient evaluation, continues with the clinicians who provide the diagnostic service, the clinicians who provide the therapeutic services and home equipment, and finally the clinicians and physician responsible for follow-up care.

Do you think heated humidifiers (HH) and expiratory pressure relief (EPR) have improved compliance? Should these modalities be included with every PAP initiation/setup?

Guth: Heated humidifiers have made a profound difference for many patients, ranging from just having the treatment become far more comfortable to making PAP treatment possible for patients suffering from vasomotor rhinitis. Some chronic sinus sufferers coming into PAP treatment have reported remarkable improvement in their sinus conditions. There are still a few patients, especially those with low prescribed CPAP pressures, who don’t need humidifiers.

Binns: I agree with Ms. Guth; heated humidification and pressure relief have improved compliance significantly. These modalities may not be for every patient, however; for those that need extra relief in pressure, it has been a blessing to have access to a device with this capacity rather than using a BiPAP, which drives up the cost for both the insurance company and the patient. Since PAP devices are portable and may be carried when travelling, it is my belief that heated humidification should be included in every device and should be utilized at the patient’s discretion. With regards to pressure relief, it also should be included in every device. Many patients treated with higher pressures initially do well, however over time they may become intolerant to higher PAP pressures and may require pressure relief.
Bollig: There have been several studies demonstrating the efficacy of heated humidifiers in improving patient compliance by decreasing the incidence of PAP side effects, although one study published in 2005 did not show any improvement in PAP compliance in spite of decreased upper airway symptoms. (Ches 2005;128:2151-8.) The AASM practice parameters for CPAP and bilevel PAP published in 2006 listed the use of heated humidification as a standard in PAP therapy used to treat adult sleep-related breathing disorders based on a review of the literature showing evidence for benefit. (Sleep 2006;29:375-380.) A number of PAP equipment manufacturers have integrated heated humidifier capability into their units, and although individual physicians have different prescription practices and may choose to assess patient response to therapy before adding humidity, an order for heated humidification is becoming quite common even at initial set-up. A recent study published in Chest in 2006 by Nils et al showed overall only a 9-minute difference in the amount of time therapy use increased with expiratory pressure relief though other studies have shown increases in use ranging from 36 minutes to an hour and 24 minutes. Certainly, each of these two features is a consideration for use in low-compliance patients who report discomfort with traditional fixed PAP pressure therapy.

What are the mask selection techniques that work for your patients?

Guth: Fitting the patient with a comfortable mask is the most important aspect of treatment. If the patient isn’t comfortable, they won’t wear it and the treatment will fail. The mask needs to be comfortable, easy to take on/off and manipulate, and to deliver the therapeutic, prescribed pressures. Mask fitting is a process that requires the skills and experience of a licensed respiratory therapist who has access to a wide selection of interfaces in various sizes that the patient can try on while lying in their normal sleep position — this is an important topic in itself. It starts with assessing and communicating with the patient to determine the patient’s physical and psychological limitations, their dexterity, their preferences and motivation for treatment. The RT should provide the patient with informed choices after determining if they are nose breathers, nose breathers plus mouth breathers, or mouth breathers. The nose breathers have the widest selection of interfaces; they can choose between nostril style interfaces that go into the nostrils or nasal masks that encircle the nose. The mouth breather usually does best with a mask that simultaneously blows air into their nose and mouth; most styles are referred to as full face masks and they surround the nose and mouth. A chin restraint can be added for the mouth breather or they can be fitted with the same type of mask used for mouth breathers. A rare mouth breather can be comfortable with an oral interface.

Binns: Look, listen and feel. Look at the patient’s facial features. Once you have sized up your patient, listen for any leaks and listen to what the patient has to say about the comfort of the mask. Also when listening, make certain to hear what your patient has to say in regards to having something on their face, such as whether they think it’s intrusive, etc. Once this has been accomplished, feel around the mask making sure there are no leaks. Have many different interfaces available. Not everyone is the same!

Bollig: Some clinicians prefer a specific style or brand of mask due to familiarity or even availability, but we find many patients prefer to make their own selection of interface from a variety of choices. Ideally, before they undergo PAP titration, our patients have the opportunity to examine several different styles and then practice wearing the mask while on low levels of CPAP.

What issues do you face today in terms of interface choices? Does the type of interface influence patient compliance? Why?

Guth: The contrast between the choices and greatly improved mask technology between 20 years ago and now are profound. Twenty years ago when few mask choices were available, it was a tremendous challenge to fit a patient with a mask that didn’t leak into their eyes and/or create a serious nose bridge ulcer. A large selection of masks now exists. Three mask technology advances have greatly contributed to more comfortable, easier-to-fit interfaces. The brilliant bubble effect of a thin membrane contoured over a stiffer inner membrane that catches air between the two layers has greatly decreased the nose bridge ulcer problem and has improved the overall seal. Nostril type interfaces with various types of simple headgear has allowed patients to avoid the nose bridge dilemma altogether and has made it possible for them to wear glasses. A variety of well-fitting full-face masks make PAP treatment possible for mouth breathers; in some cases, it has literally been a lifesaver. Although the mask technology has greatly advanced, the patients are always seeking a higher level of comfort and ease.

Binns: There are many types of interfaces today. They all have their good points; however, clearly not all of them can accommodate all needs. Every patient is different with respect to what they find comfortable. Interfaces can influence compliance. If the patient is not well-trained in utilizing the mask, they may not be compliant in its use.

Bollig: A significant problem is the inability of some DME providers to provide a sufficient variety of mask choices to the patient. Some providers are limited on mask choice because of company contractual agreements or they may exhibit their own preference. Most are willing to make a special order when a patient or physician requests a specific brand of mask, although in some instances this may cause a delay in initial setup. Alternatively, setting up the patient’s therapy with a less than ideal interface may decrease initial comfort and long-term compliance. The literature suggests that initial comfort and success with PAP therapy during the initial titration exposure and in the first few days following initiation of therapy have a strong predictive value on long-term compliance.

What concerns do you take into consideration when selecting PAP therapy equipment for your patients?

Guth: The factors that determine which PAP models providers stock include therapeutic and convenience features of the product, durability, price, favorable financing options, superior service from the companies, and requests to carry certain products by referring clinicians. The patients want PAP devices that are small, quiet and easy to use. They should be durable and rarely need repairs, which are costly and time consuming. The pricing is important because Medicare and private insurance carriers limit what they will cover. Some affluent patients don’t mind paying a premium for a superior model but many people want to minimize their out-of-pocket costs. Because the PAP devices are usually rented to purchase and the insurance companies do what they can to delay claim payments, it is important to get favorable financing through the manufacturers or finance companies. If this isn’t done, a cash flow situation will occur that can shut down the business. The technology is constantly on the move. Companies that provide service oriented reps and respond to requests and questions in a timely fashion are greatly valued.

Binns: Addressing high pressure patients is one consideration. Asking questions regarding their comfort and normal night routine should also be considered.

Bollig: It is important to determine the equipment and supplies that will be readily available to your patient and attempt to
work within that framework. Our service is located in a rural community and, as such, a large number of our patients do not live locally. These patients may have access to a limited choice of DME providers who in turn may have limited access to different PAP equipment. Whenever possible, if there is a question of available equipment, I believe it is beneficial to attempt to use the same interface that the patient has access to. If that particular interface or mask does not meet the patient’s needs, then we have the opportunity to obtain the patient’s choice in advance. In our experience, the mask interface is the most crucial equipment component in determining patient comfort and ultimate success.

What are the keys to long-term adherence and compliance to PAP therapy?

Guth: The keys to long-term adherence include starting off on the right foot by being professional, thorough and caring, and providing consistent short- and long-term follow-up by skilled respiratory therapists. The patient needs to feel welcome and should receive individual attention that addresses their unique needs and personalities. It is important to set a tone of excitement and encourage the patient that their life will be better with this treatment. All this results in the development of a trusting, long-term relationship with the patient that is mutually gratifying and beneficial.

Binns: Overall long term adherence decreases the incidence of cardiac disease. The key to its success is comfort, and education — always addressing the patient’s needs.

Bollig: There are a number of influential issues identified in the literature including severity of disease, associated sleepiness, age, and the initial experience with PAP therapy, though two of the major factors are likely patient education coupled with follow-up and patient comfort. Patient comfort will depend greatly on the appropriate mask and equipment selection in addition to appropriate PAP settings.

What do you want to see in the future from PAP therapy manufacturers? What should the machines be like? What should the interfaces be like?

Guth: The advances in PAP technology have been truly remarkable. It is especially appreciated by some of our long-term patients who replace their old, worn-out machines. Keeping the machines small, quiet, and easy to use is the key. The masks need to be easy to take on and off without coming apart. Manufacturers should consult with the experienced RTs who are familiar with what the patients like and what they are capable of doing before they develop new products and before products are released to the public. Too often, it appears that patient preference and limitations have been entirely ignored. Manufacturers need to understand that the majority of patients are elderly and many people are mechanically and dexterously challenged. Although full face masks have greatly improved and there are many choices, it is still challenging to fit them so that they are quiet, leak-proof, comfortable, and easy to take on and off. I understand that this is a difficult request to fill.

Binns: PAP devices in the future should have more information available for compliance. The machines should become more sophisticated with computerized chips, which shall have the ability to extract more information to assist the patient as well as the therapist and dispensing company. Interfaces will be made out of high tech materials, which will assist the patient in many ways, such as durability and the ability to mold to many facial forms. In response to Diana’s comment, there is a new dual-airway interface available that combines nasal pillows with an oral cushion that addresses the problems associated with full face masks (Hybrid™ Universal Interface, Teleflex Medical). Additionally, there are now sophisticated servo ventilation devices that show promise in the area of complex sleep apnea (AutoSV™ Respironics and AdaptSV™ Resmed).

Bollig: The manufacturers have already made great strides in the refinement of PAP therapy machines and continue to generate innovative interface designs. I would anticipate that PAP machines would continue to evolve into smaller, quieter, and ever more portable devices. I believe manufacturers who incorporate heated humidification into their equipment better meet the needs of our patients. It appears that the selection of an appropriate mask interface and heated humidification both contribute to improved therapy compliance. With that said, it is important that a basic style of PAP equipment is affordable for even those patients that do not have insurance coverage.

Basile: I would like to thank the panel for offering their viewpoints in response to these questions. It appears that there is no great gap in opinions; rather, we seem to have a consensus. We have recorded what we need to do and depend upon you, the reader, to put these guidelines into action. We need to lean upon the health system to provide more in the way of reimbursement for the therapy, and the education time required to increase compliance to therapy. After all, if we don’t work with patients to help them become more compliant with their therapy, why do we diagnose and treat? By failing to do so, we open ourselves as medical professionals, as well as the whole sleep medicine field, to criticism with regard to our possible inaction.

Suzanne Bollig RRT, R.PSGT, R.EEG.T is currently the manager in the Sleep Center at Hays Medical Center in Kansas. In addition to serving on the AARC’s Board of Directors, Ms. Bollig has been member of the board of directors for the Kansas Respiratory Care Society for over 10 years. She has participated in planning committees for continuing education programs along with professional development and leadership mentorship programs.

Reggie Binn RPSGT has over 16 years of experience in the sleep diagnostic field. He also has worked in hospitals and privately held labs. Presently he is the CEO of New Millennium Diagnostics, Inc and the founder of the Sleep Professionals Network. He is also creator and host for need4sleepradio.com

Diana Guth BA, RRT is the founder of Home Respiratory Care, specializing in the treatment of obstructive sleep apnea and providing non-invasive ventilation to individuals with neuromuscular disorders. She is a member of the Sleep and Diagnostic Sections of the AARC. Ms. Guth has published several articles on the topic of respiratory care in homecare.

Clinical Foundations is a serial education program distributed free-of-charge to health professionals. Clinical Foundations is published by Saxe Healthcare Communications. The goal of Clinical Foundations: A Patient-Focused Education Program for Respiratory Care Professionals is to present clinically- and evidenced-based practices to assist the clinician in making an informed decision on what is best for his/her patient. Opinions expressed in Clinical Foundations are those of the authors and not necessarily of the editorial staff of Saxe Healthcare Communications. The publisher disclaims any responsibility or liability for such material. We welcome opinions and subscription requests from our readers.

Please direct your correspondence to:

Saxe Healthcare Communications
P.O. Box 1282
Burlington, VT 05402
info@saxecommunications.com
Fax: 802.872.7558
© Saxe Communications 2007
1. What is the estimated prevalence of obstructive sleep apnea in the country?
   a. 10% of the US population
   b. 20% of the US population
   c. 2–4% of the US population
   d. 20–40% of the US population

2. Somnoplasty primarily uses low-power, low-temperature radiofrequency energy to:
   a. create finely controlled coagulative lesions.
   b. burn away (remove) excessive tissue.
   c. remove the uvula
   d. remove adipose tissue

3. Rapid Mandibular Expansion Therapy (RME), is used in patients who are:
   a. Children who are diagnosed with bruxism
   b. Adults who are diagnosed with OSAS
   c. Any patient who is diagnosed with OSAS
   d. Children who are diagnosed with OSAS

4. Recording of polysomnograms should have a minimum of:
   a. 8 channels
   b. 12 channels
   c. 16 channels
   d. 20 channels

5. Mandibular repositioning devices have a compliance rate after 2 years of:
   a. 45%
   b. 65%
   c. 75%
   d. 85%

6. Required parameters for recording of Polysomnograms include all of the following except:
   a. electroencephalogram
   b. submentalis
   c. end tidal CO2
   d. body position

7. Proper fitting of the PAP interface is critical to the success of PAP therapy
   a. True
   b. False

8. How many hours on PAP therapy for how many nights a week is commonly viewed as therapeutically beneficial?
   a. 8 hours per night 1 night per week
   b. 4 hours per night 4 nights per week
   c. 4 hours per night 3 nights per week
   d. 4 hours per night 5 nights per week

9. The role of patient education is improving compliance is:
   a. highly important for all users
   b. minimally important
   c. important only for children
   d. important only for adults

10. The use of heated humidification in PAP therapy has:
    a. not been beneficial
    b. proven to improve AHI
    c. improved patient compliance
    d. decreased patient compliance

11. When fitting a patient with a PAP therapy mask or interface you should consider the following:
    a. the size of the patient’s nose
    b. the patient’s preferences, nasal resistance and size
    c. the cost of the interface and size of patient’s nose
    d. the patient’s preference

12. The patient’s initial comfort and success with PAP therapy during the initial titration exposure and in the first few days following initiation of therapy:
    a. has little to do with their long-term compliance to therapy
    b. has a strong predictive value on long-term compliance
    c. is dependent upon the cost of the PAP therapy equipment
    d. is a direct result of the type of sleep study they received

13. When selecting PAP equipment, the primary consideration should be:
    a. cost, equipment features and company support
    b. cost
    c. cost, accompanying literature
    d. company support

**To earn credit, do the following:**
1. Read the educational offering (both articles).
2. Complete the post-test for the educational offering online at www.saxetesting.com/cf. The questions are the same as above.
3. Complete the learner evaluation.
4. To earn 2.0 contact hours of continuing education, you must achieve a score of 75% or more. If you do not pass the test, you may take it again one more time. You will not be charged to take the test a second time.
5. Upon completion, you may print out your certificate immediately. If you are an AARC member, your results are automatically forwarded to the AARC.
7. This article is no longer sponsored by Teleflex. You may still take this test and receive accreditation, however there is a nominal fee ($10.00) to cover the cost of accreditation and scoring. You may take this test 2 times at no additional charge.

**Participant’s Evaluation**

The goal of this program is to educate healthcare professionals on the management of OSA.

2. Indicate to what degree the program met the objectives:
   - Strongly Agree
   - Strongly Disagree
   - 1
   - 2
   - 3
   - 4
   - 5
   - 6

**Questions**

1. What is the estimated prevalence of obstructive sleep apnea in the country?
2. Somnoplasty primarily uses low-power, low-temperature radiofrequency energy to:
3. Rapid Mandibular Expansion Therapy (RME), is used in patients who are?
4. Recording of polysomnograms should have a minimum of:
5. Mandibular repositioning devices have a compliance rate after 2 years of:
6. Required parameters for recording of Polysomnograms include all of the following except:
7. Proper fitting of the PAP interface is critical to the success of PAP therapy
8. How many hours on PAP therapy for how many nights a week is commonly viewed as therapeutically beneficial?
9. The role of patient education is improving compliance is:
10. The use of heated humidification in PAP therapy has:
11. When fitting a patient with a PAP therapy mask or interface you should consider the following:
12. The patient’s initial comfort and success with PAP therapy during the initial titration exposure and in the first few days following initiation of therapy:
13. When selecting PAP equipment, the primary consideration should be:

This test can now be taken online. Go to www.saxetesting.com and log in. Upon successful completion, your certificate can be printed out immediately. AARC and AAST members’ results are automatically forwarded to the AARC and the AAST for accreditation.

**Answers**

1. A B C D
2. A B C D
3. A B C D
4. A B C D
5. A B C D
6. A B C D
7. A B C D

This article is no longer sponsored by Teleflex. You may still take this test and receive accreditation, however there is a nominal fee ($10.00) to cover the cost of accreditation and scoring.

All tests must be taken online at http://www.saxetesting.com/cf/