It is important that CPAP patients remain compliant with treatment and physicians routinely assess CPAP effectiveness.

CPAP compliance refers to how long the patient uses CPAP on a nightly basis. Current evidence suggests that about 68.5% of those prescribed CPAP will accept their treatment. There is no universally accepted definition of compliance. A few studies have determined that a compliant patient is one who uses CPAP 4 hours a night for more than 70% of nights. The National Association for Medical Directors of Respiratory Care has recommended to the Centers for Medicare and Medicaid Services that compliance is achieved if a patient uses CPAP 22.5 hours a day with symptomatic relief. Several studies have tried to determine the percentage of patients that are compliant with CPAP treatment, and estimates range from 46% to 80%.

It has been determined that compliance to CPAP is achieved within the first few weeks after therapy is initiated. Success is based on the level of initial education, proper selection of interface device, appropriate fitting of interface device, and overall support to troubleshoot and follow up with the patient.

There are a number of factors that cause poor compliance to CPAP. Dry, congested, and/or sore noses and throats are the most common side effects associated with CPAP treatment. Up to 75% of patients may experience these symptoms. Patients also commonly (50%) complain about side effects related to the mask fit, such as air leaks, silicone allergies, pain, or abrasion to the bridge of the nose and pressure sores. Other adverse effects of CPAP include aerophagia (air swallowing), bed partner intolerance, claustrophobia, chest discomfort, and inconvenience. All of these adverse effects can influence acceptance and compliance of CPAP treatment, as the problems suffered by the patient may outweigh the perceived treatment benefit. As more research is done, it is becoming obvious that patterns of compliance are established at the very beginning of treatment. Therefore, it is essential that optimal conditions be achieved at the outset in order to establish high patient compliance.

Compliance can be assessed in a number of different ways, one of which is subjective patient use reports. This can be achieved via telephone interviews. One objective measure of compliance is to employ an hour usage meter to identify and record the average number of hours CPAP is used per day. Compliance can also be measured and recorded using a modem, reporting overall CPAP use and even the pressure setting, based on the initial prescribed pressure. Three factors have been identified as able to significantly improve patient acceptance and compliance. These are patient education, optimization of mask comfort, and heated humidification.

Patient Education

It has been shown that the type and degree of patient education can affect the extent of patient compliance for any specific medical condition. Compliance monitoring and the programs that have been produced to achieve this allow those involved in patient support to determine if the interventions they have in place are working. Subsequently, there have been a number of studies that have researched the effect of patient education on CPAP compliance. The majority of these studies have shown that any extra effort to support and assist those new to CPAP has increased patient compliance.

Hoy et al. showed in a randomized controlled trial that intensive support in the form of CPAP education for patient and partner, and additional nights in the sleep facility significantly increased CPAP usage (3.8-5.4 hours). A randomized clinical trial has shown that the simplest intervention will increase patient compliance. In this study, the group of patients that received printed literature explaining the benefits of CPAP and guidelines for CPAP use used their prescribed CPAP machines for an average of 7.1 hours per night. This compared to the control group that received no information and used their units for an average of 4.4 hours per night.

Clinic sessions that are designed to educate and encourage patient compliance significantly increase patient compliance to CPAP. Russo-Magno et al. found that in older male patients with OSA, compliance with CPAP therapy is associated with attendance at a patient CPAP education and support group. Resolution of symptoms with therapy also appears to be associated with enhanced compliance.

Sin et al. assessed long-term compliance rates of patients treated in a group CPAP program consisting of consistent
follow-up, troubleshooting, and regular feedback to both patients and physicians. From this study, it was determined that this type of program can achieve CPAP compliance rates of >85% over 6 months.

In all of the above-mentioned studies, it is apparent that the more patients can be made aware of the benefits from CPAP treatment, the better.

**Heated Humidification**

Up to 75% of patients treated with CPAP experience a dry and congested nose as a consequence of treatment.\(^8,9\) This is caused by the drying airflow supplied by CPAP. The dry airflow can exceed the natural ability of the nose to heat and humidify the incoming air. Congestion encourages oral breathing, which, in turn, allows the pressurized air supplied by CPAP to escape through the mouth. This phenomenon is known as mouth leak. It has been shown that patients receiving dry air from CPAP experience mouth leaks an average of 31% of their total sleep time.\(^21\)

Patients eventually exhibit symptoms such as dry nose and throat; headache; chest discomfort; breakdown of tissue around the nares; dry cracked lips; infections of the nose, throat and sinuses; and bleeding nose.

Russo-Magno et al\(^{19}\) was able to show that supplying heated humidification to the air provided by CPAP will prevent the increase in nasal mucosal blood flux. As the tissues no longer experience the rush of blood to the nasal mucosa, the increase in congestion is reduced. This fact is confirmed by research conducted by Sin et al\(^{20}\) who used mouth breathing to simulate the effects of a mouth leak. If mouth breathing occurred with air that had been through a heated humidifier, nasal resistance was similar to that seen for nasal breathing. In line with this work is a study by Martins de Araujo and colleagues\(^{21}\) who showed that heated humidification can significantly attenuate the decrease in relative humidity caused by mouth leak. Therefore, heated humidification coupled with CPAP can prevent or diminish mucosal dehydration, thus reducing nasal dryness and discomfort. One research group has also suggested that normalizing the environment of the nose by adding heat and moisture can prevent the mucosal changes that occur while using dry CPAP.\(^{11}\)

Heated humidification added to CPAP will decrease nasal side effects and also reduce mouth leaking. A direct result of this is increased compliance to treatment. This has been demonstrated clinically by Rakotonanahary et al,\(^{18}\) who showed that patients who were not receiving heated humidification but had nasal problems used their machines for an average of 3.51 hours per day. Once they were given heated humidification, their CPAP use significantly increased to 5.38 hours per day (\(P = 4.10-4\)). Similarly, Massie and colleagues\(^4\) showed that those patients who receive heated humidification are significantly more compliant with their CPAP therapy than those who do not.

**Cold Passover Humidification**

In cold passover (passive) humidification, pressurized air passes through a container with a large surface area half-filled with water, causing the air to absorb moisture. Cold passover humidification is often used as an interim treatment for those patients who complain of nasal symptoms after the initiation of CPAP treatment; however, there is no evidence currently available that supports cold-passover use in this situation. Sin et al\(^{20}\) showed that nasal airway resistance was increased to a similar level regardless of whether humidity was present when cold passover was used. In accordance with this finding, the two studies that have looked at possible increases in CPAP therapy compliance with cold passover humidification have been unable to show a significant increase in the average hourly use of CPAP\(^4,18\); however, heated humidification has been shown to significantly increase CPAP compliance.

**CPAP and Interface Options**

Poorly fitting masks may result in air leaks and, subsequently, in a drop in pressure leading to persistent sleep apnea and sleep fragmentation. The leak is usually the source of considerable discomfort; if it is directed toward the eye, it may cause conjunctivitis.\(^10\) A common problem with poor fitting masks is the development of bruising or even ulceration of the bridge of the nose. This is usually the result of applying too much tension on the headband by pulling the top of the mask too tightly onto the bridge of the nose.\(^8\) This is an area where there is little subcutaneous tissue to cushion the mask, and it is therefore vulnerable to pressure injury. A good CPAP interface fit is crucial to the acceptance and compliance of CPAP treatment; therefore, it is essential that the initial education includes identifying the appropriate size and type of interface device that will allow for increased patient comfort, which leads to acceptance and compliance.

**Systematic Review of Evidence on CPAP Compliance**

We conducted a systematic review of studies that have been published in peer-reviewed medical journals regarding patients treated with CPAP and factors associated with compliance. The evidence shows that in many patients, there are no significant differences in compliance at 2 weeks, 4 weeks, 3 months, and 6 months. Thus, there is no evidence that supports monitoring compliance beyond 1 month in the absence of patients’ complaints of symptoms.
Patients are typically compliant to CPAP within the first few weeks after therapy is initiated. The evidence shows that success with compliance is based on the level of initial education, interface device, humidification, and support to troubleshoot and follow up with the patient.7

The evidence shows that there is a direct correlation between patient’s acceptance of treatment and severity of the apnea hypopnea index (AHI). Also, high Epworth Sleepiness Scale (ESS) scores and severity of symptoms before treatment allow for some predictability of which patients may be appropriate for treatment with CPAP and ultimately compliant with their treatment.

Auto-titration PAP (APAP) devices are as efficacious as constant CPAP and beneficial for patients requiring high pressures to enhance compliance. There is some evidence that shows that the use of bilevel PAP devices is beneficial for enhancing compliance when patients do not tolerate CPAP.

In long-term assessments of compliance (>6 months), the evidence showed a small percentage of patients to be refractory noncompliant. The evidence does not support any one intervention other than reinforcement with CPAP treatment by the physician for refractory noncompliance; however, if symptoms are resolved with treatment, patients tended to be more compliant than those in whom symptoms persist.

**Conclusion**

There is no standard definition of CPAP compliance because there is no definite agreement on frequency and duration of optimal CPAP treatment. In some studies, patients were expected to use CPAP for at least 4 hours on 70% of the days to be considered compliant. CPAP compliance includes subjective assessments in which the patient reports use and compliance. Objective assessments are based on the amount of time the patient is treated with CPAP as noted by an hour usage meter. Also effective are modem technologies that report the actual time a patient uses CPAP at the prescribed pressure. Patients who continue to experience symptomatic relief from treatment with CPAP have established long-term compliance and show little deviation in their sleep patterns.

While patients tend to subjectively overestimate their CPAP use by up to an hour, objective compliance recorded with hour counter meters is surprisingly close to effective compliance obtained with true pressure-time recordings reported by modems. CPAP use correlates with symptomatic improvement. No definite agreement on the minimum CPAP requirement exists. Early studies have chosen 4 hours as a cutoff point, and today, that seems to be a fairly close estimate.

CPAP treatment for OSA is an intrusive therapy and a lifelong commitment for patients; however, the numerous benefits, such as improved concentration, wakefulness, normalization of blood pressure, and decreased risk of cardiovascular consequences of untreated OSA, all make the successful acceptance and compliance with this treatment essential. The evidence shows that there is a correlation between patient’s acceptance of treatment and severity of the AHI.

Also, high ESS scores and severity of symptoms before treatment allow for some predictability of which patients may be appropriate for treatment with CPAP and ultimately compliant with treatment. APAP is beneficial for patients requiring high pressures to enhance compliance, and the use of bilevel PAP devices is beneficial when patients do not tolerate CPAP.

To improve patient acceptance and compliance, we must educate patients and ensure that they receive optimum treatment with a heated humidifier and an interface that is comfortable and effective. It is of paramount importance that the patient remains compliant to treatment and that the patient’s physician routinely assesses the continued effectiveness of CPAP treatment to determine whether further intervention is warranted.

_Vernon R. Pertelle, MBA, RRT, CCM, is national respiratory manager; and Robert Fary, RRT, is corporate director of respiratory, both at Apria Healthcare, Lake Forest, Calif._

**Acknowledgements**

The authors would like to thank Lisa Getson, executive vice president of clinical and business services, and Thomas Schenden, manager corporate communications, both at Apria Healthcare, and Fisher & Paykel Healthcare Inc, Homecare Services, Laguna Hills, Calif.

**References**

2. Waldhorn RE, Herrick TW, Nguyen MC, O'Donnell AE, Sodero J, Potolicchio SJ. Long-term compliance with nasal...


