

Effect of Heated Humidification on Adherence to Continuous Positive Airway Pressure Therapy in Subjects With Obstructive Sleep Apnea and Nasopharyngeal Symptoms

Numerous studies have demonstrated the efficacy of CPAP therapy for reducing symptoms (eg, daytime sleepiness), improving quality of life (QOL), reducing the risk of driving and occupational accidents, and preventing sequelae of obstructive sleep apnea (OSA), such as cardiovascular morbidity and mortality.¹⁻³

Many patients have trouble complying with CPAP therapy even though it is effective.⁴ As many as 46–73% of patients undergoing nasal CPAP therapy report considerable local persistent side effects, such as congestion, burning, sneezing, or dryness,^{5,6} which can impair adherence to the therapy.⁷ As a result, patients perceive that the therapy will cause problems and consequently refuse it. Therefore, interventions to treat these side effects could improve adherence and provide better QOL.

Heated humidification was developed for patients undergoing CPAP who experience chronic nasal congestion.⁴ The palatal seal, by which the uvula closes the nasopharynx, is not always complete during CPAP, leading to leaks.⁵ Mouth leaks during CPAP therapy seem to be particularly substantial, because use of CPAP can lead to elevated inspiratory air flow across the nasal and oral mucosa, because the nasal mucosa cannot compensate for the water transferred to inspired gases during expiration. Flow of cold air and mouth leaks through the nasal passage during nasal CPAP management generate a subjective sense of nose and mouth dryness, nasal congestion, and enhanced nasal resistance,⁶ which cause local nerves to secrete leukotrienes and vasoactive amines to increase nasal airway resistance⁷ leading to mouth breathing, a potent mechanism of oropharyngeal dryness.⁶ Oral dryness can change the oral flora and increase the risk for aspiration pneumonia.⁸ Heated humidification breaks the vicious circle produced by mouth leaks during nasal CPAP management in patients complaining of upper airway symptoms.⁹ Prior research has demonstrated that heated humidification pre-

vents dehydration from CPAP with a nasal mask leak by increasing absolute humidity.⁷ A clinical consensus has been reached that humidifiers should be used to treat local side effects related to nasal CPAP management to enhance humidity and heat in respired air.⁶ Consensus statements and guidelines for noninvasive ventilation include contradictory recommendations regarding humidification.^{10,11}

Humidity decreases congestion and dryness in patients with OSA, and heated humidification and cold pass-over humidity are frequently utilized to alleviate these symptoms. However, little is known about the effects of these kinds of humidity on adherence to CPAP therapy or nasal symptoms in patients with OSA. Heated humidification considerably improves daily adherence by 39 min, compared with that of cold pass-over humidification in patients with OSA.¹² The greater adherence was due to the relatively high proportion of patients with nasal symptoms (eg, 58% dry throat and 60% nasal congestion before therapy). These crossover studies recommend that adherence to nasal CPAP can be improved if all subjects use heated humidification at the beginning of nasal CPAP treatment. However, only patients with considerable upper airway problems may benefit from heated humidification. Several CPAP studies have been performed with and without heated humidification at the beginning of treatment for 1 or 2 nights^{13,14}; it was concluded that heated humidification offered no added benefit concerning further CPAP adherence.

Sleep center clinicians should consider pharyngeal and nasal dryness, because these symptoms can be diminished effectively by heated humidification. Although no consensus has been reached regarding the ideal level of air humidification,^{15,16} nasal CPAP management using heated humidification has become a standard method. However, heated humidification does not prevent all side effects. Furthermore, supplementing with a humidifier adds considerable cost and difficulty to nasal CPAP treatment and complicates the practical process (hygiene, transport).¹⁷

Age strongly predicts the necessity for heated humidification in patients with OSA.¹⁸ This is not surprising, because the nose is a highly dynamic organ that undergoes considerable functional alterations during aging. Many age-dependent changes in the nose have been identified, in-

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cluding an increased probability of nasal symptoms,¹⁹ increased nasal resistance,^{19,20} and/or a deterioration of nasal mucociliary function.²¹ Age > 60 y predicts the need for heated humidification.¹⁸

Uvulopalatopharyngoplasty; surgical ear, nose, and throat procedures; and chronic disturbances of the nasal mucosa suggest the need for additional heated humidification.¹⁸ Patients who undergo an ear, nose, and throat operation are the most likely to benefit from supplemental humidification in terms of better adherence, improved QOL, and sleepiness,²² because they are aware of the support needed for mouth leaks during therapy and the possible reasons for lack of adherence to nasal CPAP treatment.¹⁸

All undesirable dryness during ventilation with mouth leaks is diminished by heated humidification and is entirely removed by the face mask.⁹ Unfortunately, despite the benefits of a full mask to diminish nasal problems, a nasal mask is more beneficial than a face mask.²³

CPAP adherence rates are 40–78%.²⁴ Because QOL and sleep are influenced by dryness in the upper respiratory tract related to CPAP, the temperature and humidity of inspired air should be increased by heated humidification. The authors determined no benefit of starting heated humidification with CPAP therapy compared with prescribing heated humidification during follow-up.

A previous study²⁵ showed that improved adherence to nasal CPAP may significantly improve QOL and postulated a considerable advantage of adding heated humidification to CPAP with a substantial air leak. Adherence to treatment justifies heated humidification in patients with OSA complaining of a nasal disturbance despite the extra financial cost.²⁶

In contrast, a few previous studies did not obtain parallel outcomes. Ryan et al²⁷ compared 4-week use of dry CPAP, CPAP with heated humidification, and CPAP with a supplementary topical nasal steroid in 125 subjects with a diagnosis of OSA (apnea-hypopnea index ≥ 10 events/h) and showed that CPAP with heated humidification decreases the frequency of nasal complaints; however, adherence rates and QOL remained unchanged by these interventions.

In this issue of the Journal Soudorn et al²⁸ compared subjects with OSA with nasopharyngeal symptoms living in a tropical climate. This investigation's subjects were randomly assigned to accept CPAP with or without heated humidification. CPAP adherence and QOL appeared to be improved when heated humidification was used in subjects with OSA with nasopharyngeal symptoms even in a tropical climate. This investigation's conclusions differ from those of other studies regarding the timing of use of heated humidification and patient selection. This study selected the group of subjects who experienced symptoms with nasal-oral side effects during the first night of the CPAP trial. So the problems associated with CPAP early

during the first night of therapy were eliminated. This study demonstrated that the most widespread reason for not initiating CPAP was general discomfort or displeasure with the CPAP device during the first night of therapy²⁴ or during the CPAP titration period.²⁹ Unfortunately, the results of this investigation may not be applicable to the general population in a tropical climate. The sample size of this study was small, and the study lasted only 4 weeks. A study with a longer duration is required to confirm clinical efficacy.

Perception of complaints and improvements in sleepiness and daily functioning appear to be the most significant factors determining treatment adherence,³⁰ and different behavioral interventions, such as sufficient education, instruction, and support also play a significant role.³¹ A substantially greater benefit of heated humidification may be gained in patients with nasal complaints before initiating CPAP.

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