

## LONG-TERM COMPLIANCE WITH CONTINUOUS POSITIVE AIRWAY PRESSURE IN PATIENTS WITH OBSTRUCTIVE SLEEP APNEA SYNDROME

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Obstructive sleep apnea syndrome (OSAS) is characterized by repetitive obstruction of upper airways during sleep, which leads to snoring and apneic episodes associated with oxygen desaturation. These episodes often end in arousal. Several chronic cardiovascular complications, such as systemic arterial hypertension,<sup>1-5</sup> pulmonary hypertension,<sup>6</sup> heart failure, arrhythmias, ischemic heart disease and stroke, have been found to be related to OSAS.<sup>7-9</sup> This may account for increased vascular mortality and sudden death in untreated patients.<sup>10-12</sup>

In 1981, Sullivan et al.<sup>13</sup> described the use of continuous positive airway pressure via the nose to treat sleep apnea. Nasal continuous positive airway pressure (nCPAP) is highly effective in reversing the abnormal physiology in most patients, and is used in chronic treatment. It was reported that mortality rates in patients with OSAS return to normal with nCPAP therapy.<sup>10</sup> It is generally a well-tolerated therapy with a reasonable cost-utility ratio,<sup>14</sup> and it is now considered to be the treatment of choice. However, patients' compliance remains a substantial obstacle with nCPAP therapy.

### *Long-Term Compliance with Continuous Positive Airway Pressure*

Several earlier studies<sup>15-17</sup> reported compliance rates ranging from 64% to 82%. However, most of these studies used subjective data and basically depended on patient reports, or the use of a questionnaire, which may have been inaccurate. The first objective compliance study was reported in 1988,<sup>18</sup> and recorded the machine run time via a built-in time counter. The mean duration of nCPAP use was reported to be 5.1 hours per night. The rate of acceptance, defined as the percentage of patients using the machine for more than three hours per night, was about 91%. However, in a similar study using a stricter definition

of compliance, i.e., use of the nCPAP machine throughout the night, every night for more than five hours per night, Meurice et al.<sup>19</sup> reported that of 44 patients with OSAS followed for a mean of 14 months, only 68% were found to be compliant. This group also reported that compliance was directly related to the severity of the syndrome at presentation, and the degree of clinical improvement with treatment. Adverse effects were not found to be a factor in determining long-term compliance.<sup>19</sup>

In another study of 47 patients with OSAS followed for six months,<sup>20</sup> 20% discontinued therapy within three months for various reasons. In the remaining patients, mean compliance, defined as the percentage of machine run time to hours of sleep reported, was found to be 68% of total sleep time. In a similar study, Kribbs et al.<sup>21</sup> reported that of 35 patients, only 16 (46%) were found to be regular users of nCPAP, which was defined as at least four hours of nCPAP administration for more than 70% of the days monitored. The rate of use was significantly higher among educated and professional patients.

In a British study<sup>22</sup> where nCPAP was supplied without charge, the mean machine run time was 4.7 hours per night in 54 patients. However, the mean machine run time of a subgroup of these patients (32 patients) was only 3.7 hours per night.<sup>23</sup> In contrast to Meurice et al.,<sup>19</sup> compliance was reported to be significantly lower in patients with side effects, and no correlation was found between compliance and severity of sleep apnea syndrome, or response to therapy. In a more recent report,<sup>24</sup> compliance with nCPAP at one year was 62% (13/21). The compliant patients used the device a minimum of five nights a week for at least four hours a night, based on the information provided by the machine's built-in counter combined with self-reports.

In contrast to the above-mentioned reports, Pepin et al.<sup>25</sup> reported a high acceptance rate in OSAS patients. Eighty-eight percent of 193 patients used an nCPAP machine every night, with a mean machine run time of 6.5 hours per night, an acceptance rate that is substantially higher than that reported in other objective studies.

Concern has been raised regarding compliance,

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following a split-night study protocol (where the diagnosis of sleep apnea and nCPAP titration are both done on the same night). This was recently addressed,<sup>26</sup> and preliminary results showed that compliance is even superior to that reported in most earlier objective studies based on routine two-night protocols.

Although it is difficult to objectively compare these study results because of the differences in the definition of compliance, one must conclude that nCPAP compliance is generally unsatisfactory. This should not be surprising, since it is a common problem in other chronic illnesses requiring long-term therapy, such as bronchial asthma and epilepsy, where the rate of compliance has been reported to be 40% and 39% respectively.<sup>27,28</sup> The relatively high cost of this device may potentially explain why compliance is bad in lower-income patients, but this is unlikely, since even in countries where an nCPAP machine is provided by the national health service free of charge, compliance is still poor.<sup>22</sup> There is no clear predictive factor for compliance. Although use of nCPAP every night has been shown to be optimal,<sup>29</sup> the minimum number of hours per night that is actually required to ameliorate OSAS symptoms is not known. Engleman et al.<sup>23</sup> reported significant improvement in daytime symptoms with nCPAP, despite a mean machine run time of only 3.7 hours.

#### *How To Improve Patients' Compliance*

1) Patient education and close follow-up: There is little published data about education of patients and the role of follow-up in improving compliance. Explaining in simple terms how nCPAP is used, and asking patients to apply it while awake and before starting the titration study, may enhance familiarity, increase confidence, and so improve the rate of acceptance. Follow-up should include home visits and periodic clinical reassessment to evaluate machine and mask use. Technical problems and unwanted effects should be recognized and resolved promptly.

Although nCPAP is a relatively safe mode of therapy, minor complications are common. In a recent report of 193 OSAS patients treated with nCPAP,<sup>25</sup> dryness of the upper airway was present in 65%, sneezing and nasal drip in more than 35%, nasal congestion in 25%, local skin irritation in 30%, eye irritation in 20%, aerophagia in 16%, sinusitis in 8% and nosebleeding in 4%. There was no relationship between the level of pressure and the prevalence of unwanted effects. These minor complications should be treated once diagnosed. Humidification of the nCPAP airstream may relieve dryness of the nasal mucosa and oropharynx, although the study of Pepin et al.<sup>25</sup> showed no significant differences in unwanted effects when humidifiers were used. Eye irritation may be prevented by avoiding mask leak and using a well-fitting mask.<sup>25</sup> Changing the mask size or brand, or using nasal

pillows, have been demonstrated to reduce local skin irritation.<sup>25,30</sup> Patients with nasal congestion and rhinorrhea may respond—particularly if they are atopic—to anti-inflammatory nasal sprays (antihistamines or steroids), decongestants or nasal anticholinergic agents.<sup>31</sup>

Such extensive patient education and follow-up may play an important role in the first few weeks of therapy, since it has been reported recently that frequency of nCPAP use may be predicted by its use in the first few weeks of prescription.<sup>21,22</sup> nCPAP run time should also be regularly recorded in all patients for continuous objective assessment of compliance, since subjective evaluation based upon patients' reports has been shown to be an inaccurate estimate of actual daily use.<sup>19,21</sup> This would allow early recognition of the infrequent user.

2) Oronasal continuous positive airway pressure: Patients who still cannot tolerate nCPAP because of nasal congestion despite a trial of medical therapy, or those with persistent dry mouth or mouth leak, may benefit from using oronasal continuous positive airway pressure with the mask covering both nose and mouth. This was recently reported to be effective in alleviating OSAS.<sup>32,33</sup> Further studies are needed to confirm its effectiveness and safety before it becomes used routinely.

3) Automatic nCPAP: This is a self-titrating (automatic) nCPAP system that senses changes in airway resistance and flow, which are affected by a number of variables such as body position, nasal congestion, sleep stage or sedatives, and adjusts mask pressure automatically. It may be superior to the conventional, manually adjusted nCPAP, where a single pressure is used throughout the night. The efficacy of self-titrating nCPAP is under current evaluation, and preliminary reports suggest that it is equally effective compared to manually adjusted nCPAP therapy in alleviating OSAS.<sup>34</sup> In one ongoing study of self-titrating nCPAP,<sup>35</sup> the number of apnea and hypopnea per hour (apnea-hypopnea index) decreased to less than five in 19 of 20 patients, nine of them requiring a mean airway pressure that was 46% lower than that determined by the conventional nCPAP. Nevertheless, because of mouth leaks, the pressure was overestimated in six patients. Although automatic nCPAP seems to be as effective as conventional nCPAP in some patients, it is not yet known whether its use will improve compliance.

4) Bilevel positive airway pressure: Some patients with OSAS complain of dyspnea and discomfort with nCPAP therapy, which decreases the acceptance rate. This is due to the increased work required for complete expiration against a high positive expiratory pressure. In such patients, a two-level positive airway pressure device with decreased expiratory pressure relative to inspiratory pressure is recommended. Reeves-Hoche et al.<sup>36</sup> recently compared bilevel positive airway pressure to nCPAP

compliance, and found that the mean night-time use of both over a 12-month period was not different (bilevel therapy: 4.9 hours, nCPAP: 5.0 hours), suggesting no difference in compliance. Therefore, the use of bilevel positive airway pressure to improve patients' acceptance remains a hypothesis that is yet to be proved.

Although nCPAP therapy is the most important therapeutic advance in the treatment of OSAS in the last decade, patients' compliance remains a significant problem. The challenge in the next decade is either to improve continuous positive airway pressure devices in order to increase the rate of acceptance, or to develop new methods of effective therapy.

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