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Key points

- Continuous positive airway pressure (CPAP) adherence is low among individuals with obstructive sleep apnoea.
- Type D personality and high scores on the depression and hypochondriasis scales on the Minnesota Multiphasic Personality Inventory (MMPI) have been identified as factors contributing to non-compliance with CPAP.
- Further research into personality type may assist in understanding why some people adhere to CPAP, while others fail.

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Does personality play a role in continuous positive airway pressure compliance?

Obstructive sleep apnoea (OSA) is a condition characterised by repetitive, intermittent partial or complete collapse/obstruction of the upper airway during sleep. Continuous positive airway pressure (CPAP) is highly efficacious in treating OSA but its effectiveness is limited due to suboptimal acceptance and adherence rates, with as many as 50% of OSA patients discontinuing CPAP treatment within the first year. Until recently, research has focused on examining mechanistic and demographic factors that could explain nonadherence (*e.g.* age, sex, race and education level) with limited applicability in a prospective or clinical manner.

More recent research has focused on personality factors or types of patients with OSA who comply and do not comply with CPAP adherence in an attempt to enhance the accuracy of predicting treatment compliance. Type D personality has been found to be prevalent in one third of patients with OSA. The presence of Type D personality increases noncompliance and poor treatment outcomes due to negative affectivity, social inhibition, unhealthy lifestyle, and a reluctance to consult and/or follow medical advice. Conversely, individuals who are more likely to adhere to CPAP treatment tend to have a high internal locus of control and high self-efficacy, self-refer for treatment, and have active coping skills. By assessing personality and coping skills, the clinician may gain insight into the likelihood of a patient's adherence to treatment. If the patient displays potential risk factors for CPAP noncompliance, the clinician can offer the patient education, refer them to a support group, engage in behavioural/motivational therapy and undertake regular follow-up visits or phone calls incorporating troubleshooting to increase CPAP adherence, especially in individuals with Type D personality.

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OSA patients should be assessed for Type D personality to determine likely CPAP compliance
http://ow.ly/Dlbb309cMPH

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Obstructive sleep apnoea (OSA) is a condition characterised by repetitive, intermittent partial or complete collapse/obstruction of the upper airway during sleep. During wakefulness, dilator muscles contract during inspiration to maintain airway patency. This prevents collapse as a consequence of suction during inspiration. However, during sleep, the tone of these muscles falls, causing narrowing or total obstruction of the airway.

Continuous positive airway pressure (CPAP) is highly efficacious in treating OSA but its effectiveness is limited due to suboptimal acceptance and adherence rates; 5–89% of patients will reject CPAP as a treatment immediately, 25–50% of patients who

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commence treatment will fail to continue [1–4], 50% will discontinue CPAP treatment within 1 year [5] and 25% terminate CPAP treatment within 3 years [1]. This large prevalence of nonadherence decreases its effectiveness, and is limited in improving daytime sleepiness, mental and physical health, and cognitive functioning [1, 6]. These nonadherence numbers are similar to other populations with health concerns, where roughly 20–40% of individuals with acute illness, 30–60% with chronic illness and 50–80% of those using preventative care are nonadherent to their prescribed medical treatment [5].

Research has focused on finding common qualities and/or circumstances that may lead to nonadherence, such as age, sex, race, apnoea hypopnea index (AHI), body mass index (BMI) and education levels, but these have been inconclusive, equivocal or confounded by other demographic variables [1, 4]. Therefore, more recent research has focused on the psychosocial and personality traits that may contribute to noncompliance, shifting the focus of patient treatment from socioeconomic, physical and environmental predictors to that of more stable personality factors [1, 2, 5].

Aikens *et al*. [7] evaluated patients with OSA using the Minnesota Multiphasic Personality Inventory (MMPI), and discovered that 58% of these patients demonstrated at least one MMPI elevation and 38% had two or more, with depression, hypochondriasis and hysteria being the highest. From this study, it was reported that those with core depressive symptoms on the MMPI had less severe OSA, and those with a diverse set of psychological symptoms stronger than depression had a greater AHI and lower oxygen saturation [7]. Depressive symptoms and anxiety are often seen in patients with OSA, which worsens fatigue, but CPAP decreases fatigue providing significant improvement in depression and anxiety [8]. OSA patient satisfaction with CPAP treatment positively correlates with adherence, with the greater the day to day improvement noticed the greater the likelihood of using CPAP [9].

Methods

Method

We conducted a review of published, peer-reviewed articles on personality factors that increase risk of nonadherence to CPAP therapy.

Search strategy

The databases used to search the literature for this review were MEDLINE (2000–present), EMBASE (2000–present), PsycINFO (2000–present), SCOPUS (2000–present) and PubMed (2000–present). These databases allowed for a wide range of clinical medical material to be covered over a broad base of global journals. Each database was searched between August and November 2016. Recommendations from the Cochrane Collaboration for a comprehensive, sensitive and wide-variety search were followed to ensure all the highest standards in evidence-based research were undertaken and all relevant articles for this review were identified for review [10]. No conflicts of interest were identified. The following search terms were used; ([CPAP] OR [continuous positive airway pressure]) AND [(OSA) OR (obstructive sleep apnoea or obstructive sleep apnea)] AND (personality)] AND [(non-compliance or compliance]. The additional limit was "to all adult (plus 18 years)" (table 1).

Study selection

All titles and abstracts were assessed and full texts of the relevant studies were obtained if they fulfilled the required inclusion criteria (see later). Selected publications were assessed by two reviewers (E.L. Maschauer and D. Fairley) separately to reduce selection bias. Once a list of articles was created that each reviewer felt met the inclusion criteria, they met to compare results and discuss which articles would be included in the final review.

Study type

The inclusion criteria were that the studies had to investigate personality types, factors or traits in individuals with OSA and compliant/noncompliant CPAP use. All studies that did not meet the criteria or were not peer-reviewed, published articles were not included in the review. Duplicate studies and those that were not in English were excluded.

Study group

The study group had to have consisted of adults over the age of 18 years with OSA on CPAP.

Date of Publication

Studies published between 2000 and 2016 were eligible.

This search identified a total of 13 studies to be included in the review (table 1). The measures used to assess personality factors in these articles consisted of the:

- MMPI, which scores indicators of personality characteristics [11, 12];
- behavioural inhibition system/behavioural activation system (BIS/BAS) questionnaires exploring appetitive and aversive motives [4];
- Type D scale (DS14 and DS16) to assess for Type D personality [3, 6, 9];
- Big Five, NEO Five Factor Inventory and Mini-International Personality Item Pool, which all measure the five main domains of personality (neuroticism, extraversion, openness, agreeableness and conscientiousness) [4, 9];

Table 1 *Summary of studies included in this review*

Study	Participants	Intervention	Methods	Outcomes
Olsen *et al.* [1]	1488 patients with OSA from various studies 1247 male 241 female Age: 46–60 years	An overview of psychologically informed interventions for CPAP adherence The HBM was used in prediction of both CPAP acceptance and adherence	Moderated regression techniques	Applying theoretical models to OSA research has substantially improved the understanding of psychological constructs in CPAP adherence Using psychological and educational interventions for improving CPAP adherence is an understudied area of research; however, CBT-based interventions as well as motivational interventions addressing aspects of CPAP use are suggested as appropriate interventions for this population
Wild *et al.* [2]	119 patients with OSAHS attending a sleep centre for overnight CPAP titration over an 8-month period 94 male 25 female Age: mean 51 years	Patients completed health value, health locus and self-efficacy prior to CPAP titration	Three psychological measures were used in accordance with Wallston's learning theory	Objective adherence data measured using CPAP run-time clocks were collected At 3-month follow-up, the mean CPAP use was 3.6±2.7 h per night in this population with 21 (18%) participants receiving some technical intervention for CPAP-related side-effects
Broström *et al.* [3]	247 patients recruited from a CPAP clinic with three 1-h visits over a period of 2 weeks 203 male 44 female Age: mean 60 years	SECI was posted to perceive the effects on CPAP adherence	ESS, OSAS severity variable and objective adherences to CPAP treatment were obtained from the medical records	Type D patients scored significantly higher ($p<0.05–0.001$) in 12 of the 15 side-effects compared with non-Type D patients A total of 74 (30%) of the patients with OSAS (28% of the men *versus* 39% of the women) had Type D personality
Bollig [5]	Review of multiple studies	Clinical status outcomes were collected both before and after 3 months of therapy with questionnaires	ESS, MSLT and FOSQ	Type D personality OSA patients reported a higher complaint of adverse effects from CPAP therapy and reported a higher rate of continued sleepiness than non-D personalities In a discussion, 50% of patients with Type D personality used their CPAP <4 h per night, compared to 16% of the non-Type D participants
Dieltjens *et al.* [6]	82 patients out of 113 with a known baseline type D scale started using MAD treatment between 2006/2009 58 male 24 female Age: mean 50±1 years	82 patients from 113 patients using MAD completed the DS14 Type D scale at baseline then follow up at 2 years	SDB diagnosis started on a MAD device with demographic and clinical data including results from DS14, and a perceived side-effects and adherence postal questionnaire	Characteristics of the 82 patients: BMI 27.9±4.3 kg•m^{-2}; AHI 17±13 events per h; ESS 10±5; VAS 6±2 Of the Type D patients, 45% discontinued MAD treatment with 15% of non-Type D reported treatment discontinuation

Continued

Table 1 *Continued*

Study	Participants	Intervention	Methods	Outcomes
Moran *et al.* [4]	63 participants diagnosed with OSAHS, with CPAP for 30 days, usage defined as >4 h per night on 70% of nights 31 male 32 female Age: mean 57.1 years	Predictors of adherence were identified including demographic variables and personality traits	Mini-IPIP, BIS/BAS and WAYS	On ratings from the BIS/BAS, a raised BIS was a strong predictor of nonadherence (r=–0.452, p<0.01), followed by neuroticism An elevated BIS score and neuroticism may indicate that personality factors are important in the determination of adherence to CPAP
Ekici *et al.* [11]	The MMPI was used for 94 treatment-naïve snorers and OSA people All patients with OSA and snorers were accepted with SDB (AHI >0 events per h) The threshold of 5 events per h sleep was chosen to define both OSA and snorers	Admitted for overnight PSG with questionnaires	PSG, MMPI, Fatigue scale, Adult ADHD scale, ESS, and SF-36	OSA patients scored significantly higher on Hs scale (65.0±12.0 *versus* 58.4±7.9, p=0.01) OSA patients compared to snorers have significantly higher rate of clinical elevation on both Pd (13.0 *versus* 0%, p=0.03) and Hs (26.1 *versus* 3.3%, p=0.01) The results of the study may indicate that patients with OSAS, compared to snorers, presented with more Hs and Pd personality characteristics
Hayashida *et al.* [12]	230 patients referred with OSAS with AHI >5 events per h; given CPAP 230 male Age: 20–73 years	ESS, MMPI, SDS, age, BMI, sleep duration during the preceding month and AHI	Single and multiple linear regression analyses were performed to estimate the association between the ESS and the other measures tested	Age had negative association with ESS score (r=–0.245, p<0.001) BMI (r=0.165, p=0.012), AHI (r=0.199, p=0.002), SDS (r=0.169, p=0.010), Hs (r=0.212, p=0.001), Hy (r=0.177, p=0.007), Pd (r=0.133, p=0.044), Pt (r=0.227, p=0.001), Sc (r=0.228, p<0.001) and Ma (r=0.163, p=0.014) all had a positive association with ESS score There were several statistically clear and significant correlations (r≥0.5) among many MMPI variables: Hs *versus* D Hy, Pd, Pt and Sc D *versus* Pt, Sc and Si Hy *versus* Pd and Pt Pd *versus* Pt and Sc Pt *versus* Sc

Continued

Table 1 *Continued*

Study	Participants	Intervention	Methods	Outcomes
Mols and Denollet [9]	2813 patients total from 12 studies Exclusion from the search included any cardiovascular population and any study with a negative affectivity or social inhibition personality	10-item standardised checklist for pre-defined criteria for systematic review on published papers	A cross-sectional design analysing Type D personality amongst non-cardiovascular patient population in a medical population	Patients with sleep apnoea on treatment reported more side-effects of treatment and were less likely to adhere to treatment than their non-type counterparts (p<0.05–0.001) Type D patients experienced their condition to be more disabling compared to non-Type D patients (40.5 *versus* 26.4; p=0.015), especially emotionally (p=0.007) and functionally (p=0.033)
Pierobon *et al.* [13]	157 patients with OSAS from an obese population 106 male 51 female Age: 47±11.9 years	CBA 2.0, neuropsychological assessment, WAIS-R, verbal span test and PSG	Cross-sectional study Patients were assessed using both psychological and neuropsychological variants	Patients reported with higher frequency, compared to the normal distribution, the presence of an extrovert personality trait and depressive behaviours: 15.9% of the patients minimised symptoms and denied distress, whereas 28.0% presented psychological disorders Compared to the normative group, patients' results were characterised as impaired with a higher percentage in short-term verbal memory (30.6%) and in short-term visual spatial memory (20.5%) Moreover, 30.6% of patients were impaired in one cognitive function, 11.5% in two, 8.9% in three, and 8.2% in four or more cognitive functions No significant relationships between psychological–neuropsychological data and clinical variables emerged
So *et al.* [14]	88 patients with UARS. 45 male 43 female Age: 36.84±13.85 years 365 patients with OSAS 299 male 66 female Age: 49.52±11.79 years	AIS, PSQI and ESS	Overnight PSG, AIS, PSQI, SCL-90-R and EPQ	The URAS group scored significantly higher than the OSA group on the ESS, AIS and PSQI (p<0.001) Scores of all SCL-90-R subscales in the UARS group were significantly higher than those in the OSA group (all were p<0.001, except somatisation, which was p=0.016) Patients with UARS also scored lower on the EPQ-E (p=0.006) and EPQ-L (p<0.001), and showed higher scores on EPQ-P (p=0.002) and EPQ-N (neuroticism) (p<0.001) than those with OSA/OSAS The ESS scores for UARS and OSAS were 10.2 and 6.8 (p<0.001) Patients with UARS are more likely to have neurotic personalities and tend to be more anxious and sensitive than patients with OSAS (psychoticism 2.97±2.37 *versus* 2.14±1.76, neuroticism 16.57±4.46 *versus* 13.10±4.89)

Continued

Table 1 *Continued*

Study	Participants	Intervention	Methods	Outcomes
Avow *et al.* [15]	8 patients recruited from a multisite sleep clinic, 4 who used CPAP for >5 h for 7 nights and 4 <1 h for 7 nights 4 male 4 female Age: 20–73 years	Demographic data, severity of OSA, extent of CPAP use, use of prescribed adjunct sedatives/ hypnotics, and selected comorbidities known to influence CPAP adherence	Semistructured interviews took place in a private office in the clinic and lasted approximately 15–60 min Questions asked about CPAP experience, CPAP use, influences for CPAP use/nonuse and biggest challenge for CPAP use	Perceived physical, psychological and social factors were found to influence both CPAP use and non-use The way patients feel about themselves influences the ways in which they manage their OSA with or without CPAP

HBM: Health Belief Model; CBT: cognitive behavioural therapy; OSHAS: obstructive sleep apnoea–hypopnoea syndrome; SECI: Side-Effects of CPAP Inventory; ESS: Epworth Sleepiness Scale; OSAS: obstructive sleep apnoea syndrome; MSLT: Multiple Sleep Latency Test; FOSQ: Functional Outcomes of Sleep Questionnaire; MAD: mandibular advancement device; SDB: sleep disordered breathing; VAS: visual analogue scale for snoring; IPIP: International Personality Item Pool; BIS/BAS: behavioural inhibition system/behavioural activation system; WAYS: Ways of Coping; PSG: polysomnography; ADHD: attention deficit/hyperactivity disorder; SF-36: 36-item Short Form Survey; Hs: hypochondriasis; Pd: psychopathic deviate; SDS: Self-Rating Depression Scale; Hy: hysteria; Pt: psychasthenia; Sc: schizophrenia; Ma: hypomania; D: depression; Si: social introversion; CBA: Cognitive Behavioural Assessment; WAIS-R: Wechsler Adult Intelligence Scale Revised; UARS: upper airway resistance syndrome; AIS: Athens Insomnia Scale: PSQI: Pittsburgh Sleep Quality Index; SCL-90-R: Symptom Checklist-90 Revision; EPQ: Eysenck Personality Questionnaire; E: extroversion/introversion; L: lie; P: psychoticism; N: neuroticism.

- DOCCO to evaluate stress, personality and lifestyle [4];
- Cognitive Behavioural Assessment, evaluating state and trait anxiety, personality characteristics, psychophysiological disorders, fears and phobias, and depressive behaviours [13];
- Ways of Coping, measuring different domains or aspects of personality, including basic descriptive traits, motivation and coping skills [4];
- Symptom Checklist-90 Revision for psychiatric symptoms [14]; and
- Eysenck Personality Questionnaire to assess personality traits measuring psychoticism, neuroticism, extraversion and lying [14] (table 2).

Personality traits of treatment noncompliers

Several studies have used personality type indicator measures (*e.g.* MMPI and Big Five) to investigate individuals with varying degrees of OSA. Type D personality appears to be prevalent in 30% of the OSA population, in contrast to only 13–24% in the general population [3, 5, 6, 9] according to several studies conducted in the USA, Sweden, Belgium, Canada, Germany and the Netherlands. Type D personality is characterised by two traits:

- negative affectivity, which is the tendency to experience negative emotions; and
- social inhibition, the hindering of emotional and behavioural expression for fear of rejection or disapproval by others [4–6, 9].

Type D is a predictor of poor health status and increased risk of mortality in other medical conditions (*e.g.* chronic pain, mild traumatic brain injury and asthma) [9]. Type D has been linked to certain negative behaviours such as an unhealthy lifestyle, reluctance to consult or follow medical advice, and poor treatment outcomes, adversely affecting the clinical course of medical conditions and treatment compliance [9]. Type D personalities are more likely to be anxious, depressed, socially inhibited, have a decreased quality of life and suffer increased psychological distress [1, 3, 6, 9, 11]. OSA patients with Type D personality have poor medication compliance, and lower adherence to CPAP and mandibular advancement devices (MADs) than those who are not Type D [3, 6]. Roughly 50% of Type D OSA patients use their CPAP for <4 h per night, unlike their non-Type D counterparts who use their CPAP for 6 h a night; 45% also discontinue MAD treatment [3, 5, 6]. Type D personalities are more likely to have medical comorbidities, a decreased personal view of their own health, decreased physical functioning and poor psychosocial functioning [9]. Their subjective perception of the problem does not always adequately reflect the actual severity of the condition, and they report side-effects of CPAP

Table 2 *Personality tests used in this review*

Test	What it measures	Test information
MMPI [11, 12]	Personality characteristics on 10 clinical scales: Hypochondriasis Depression Hysteria Psychopathic deviate Masculinity/femininity Paranoia Psychasthenia Schizophrenia Hypomania Social introversion	567 items True/false
BIS/BAS [7]	Appetite and aversive motives	BAS regulates appetitive motives, moves toward something desired, sensitive to reward and escape from punishment, and associated with positive affect and optimism BIS regulates aversive motives, moves away from something aversive, sensitive to punishment and nonreward, and related to fear and anxiety
DS14 and DS16 [4, 6, 13]	Type D personality	DS14 contains 14 items and a 5-point Likert-type scale ranging from 0 (false) to 4 (true) is used to measure the subjects' personalities DS16 contains 8 items with negative affectivity and 8 items about social inhibition answered with a 5-point Likert rating scale.
The Big Five [7]	Five main domains of personality (OCEAN)	50 questions to rate on how true they are about the person on a 5-point Likert-scale (1, disagree; 3, neutral; 5, agree)
NEO-FFI [13]	Five main domains of personality (OCEAN)	60 questions assessing the essentials of personality
Mini-IPIP [7]	Five main domains of personality (OCEAN)	20 questions containing 4 items for each of the Big Five traits indicating the degree the statement applies to them on a 5-point scale
DOCCO [7]	Stress, personality and lifestyle	200 questions
CBA [14]	State and trait anxiety, personality characteristics, psychophysiological disorders, fears and phobias, and depressive behaviours	Includes an anamnestic schedule providing information on habits, personal history, sleep, eating behaviour, work, *etc.*
WAYS [7]	Different domains or aspects of personality, including basic descriptive traits, motivation and coping skills	66 items to measure thoughts and actions used in stressful situations Measures 8 coping factors: confrontive coping distancing self-controlling seeking social support accepting responsibility escape avoidance planful problem solving positive reappraisal

Continued

Table 2 *Continued*

Test	What it measures	Test information
SCL-90-R [16]	Psychiatric symptoms	Multidimensional, self-report symptom inventory consisting of 90 items divided into 9 symptom dimensions: somatisation obsessive-compulsive interpersonal sensitivity depression anxiety hostility phobic anxiety paranoid ideation psychoticism
EPQ [16]	Personality traits measuring psychoticism, neuroticism, extraversion and lying	4-item measures of psychoticism (social psychopath, solitary, troublesome, cruel and inhumane traits), neuroticism (anxious, worrying, moody and frequently depressed), extraversion (sociable, craves excitement, carefree and optimistic) and lying (social desirability)

NEO-FFI: NEO Five Factor Inventory; IPIP: International Personality Item Pool; CBA: Cognitive Behavioural Assessment; WAYS: Ways of Coping; SCL-90-R: Symptom Checklist-90 Revision; OCEAN: openness, conscientiousness, extroversion, agreeableness and neuroticism.

more frequently (*e.g.* dry throat and mask leaks) [1, 3, 9]. Type D decreased adherence to CPAP may also be caused by decreased perceived effects of the treatment and low self-efficacy [3].

When compared to those with snoring, OSA patients have significantly higher absolute scores on the hypochondriasis, psychopathic deviance and depression scales of the MMPI [1, 11]. Scores high on the depression and hypochondriasis scales also predict low CPAP adherence [16]. The hypochondriasis scale measures an over-concern with one's state of health [4] and high scores indicate extreme attention to physical symptoms, chronic fatigue and weakness, and noticing vague symptoms, which lead to higher rates of noncompliance [11]. High scores on the hypochondriasis scale also influence subjective daytime sleepiness [12]. High scores on psychopathic deviance may show difficulty adhering to rules and following the advice of authority figures/medical staff, and failing to learn from past mistakes, again increasing risk of continual nonadherence [11]. The prevalence rate of depression in OSA compared to people without OSA is roughly 33%, which may be a direct consequence of sleep deprivation or could be an indirect consequence of social effects caused by the disorder [13], as long-term sleep deprivation can adversely affect mood [3]. Individuals with OSA tend to have a higher BMI than the normative population [15] and obesity is associated with an increased risk of depression as well [13].

The personality patterns of OSA patients with low CPAP adherence have been found to be a somatic–neurotic type, consisting of physical symptoms that derive from the psyche more than from a physical illness [11]. This increased somatic development of symptoms creates a high level of psychological distress for the patient, as a consequence of OSA, not as a cause of it [11]. Other factors that increase low adherence to CPAP are OSA patients who exhibit a significantly high level of denial of disease severity, hysterical personality characteristics, decreased physical activity, feelings of guilt, a pessimistic outlook on life and low self-esteem [11]. Individuals with Type D score high on neuroticism, low on extraversion and low on conscientiousness when evaluated using the Big Five personality model, and score high on the BIS, displaying avoidance and aversion to unpleasant stimuli [4, 9]. The higher scores on the BIS are possibly due to fear and anxiety developing with respect to CPAP being an invasive and undeniable long-term treatment [4].

Another factor that could give insight into whether a patient will have low CPAP adherence is knowing who scheduled the patient for treatment. If the patient's partner refers them, rather than the patient referring themselves, adherence to CPAP decreases [2]. This phenomenon may be due to Type D personalities having a high external locus of control (*e.g.* believing their health is determined by external forces, not the internal self) or minimising

their symptoms, thereby not considering treatment to be necessary [1–3, 15].

Personality traits of treatment compliance

Patients who have a high internal locus of control (*e.g.* believing they have control over their health) are more likely to adhere to CPAP treatment [1–3, 15]. This is due to internalising and following advice received from sleep specialists, having the ability not to perseverate on treatment side-effects, and displaying high self-efficacy [2]. High self-efficacy empowers individuals to believe in their own ability to deal with obstacles and take control of their own health [5], thus increasing treatment compliance. This also explains why self-referring patients are more likely to adhere to treatment.

Individuals with a high level of conscientiousness and openness, active coping skills, and problem solving traits are also most likely to adhere to treatment [4]. Implementation of coping strategies/skills in demanding situations can lead to a higher overall level of CPAP use per night and continued use over time [2].

CPAP adherence is also increased if a patient is educated on the negative health outcomes that will develop as a result of not using the treatment, as well as believing they have a more severe form of the disorder [2]. Physiological measures of disease severity rarely accurately predict >10% of the variance in adherence [1] but the patient's belief that his/her OSA is severe will lead to higher treatment compliance.

Those who comply more with CPAP tend to have a higher BMI, report less daytime sleepiness, report better nocturnal sleep quality, and score lower on the depression and hypochondriasis scales on the MMPI prior to treatment [16]. These five predictors identify ~80% of individuals who eventually fail to comply with CPAP treatment as well as 97% of those who comply long-term [16].

Discussion

Despite CPAP being an effective treatment for OSA, improving quality of sleep, excessive daytime sleepiness (EDS) and road accidents, patient adherence to this device is relatively low. By better understanding which factors play into the prediction of treatment noncompliance, health professionals can create preventative plans and support systems for patients to increase adherence. One way to increase CPAP adherence is for clinicians to use a short personality inventory (DS14 is recommended [9]) and a coping skills questionnaire to evaluate OSA patients. From this information, clinicians can determine if the patient has a Type D personality and assess active coping skills, whilst the patient awaits CPAP titration. Screening patients before treatment may allow clinicians the opportunity of prescribing a structured, well-designed intervention that is focused on improving the patient's self-management, coping skills and self-efficacy, thus improving adherence and long-term continuation of CPAP [3, 6].

Assessing for anxiety and depression pre-treatment has been found to strongly predict CPAP adherence and may lead to better subsequent CPAP use by educating the patient on how CPAP decreases depression and anxiety [1, 4, 5]. The goal of the CPAP titration appointment should not simply be about treating OSA but should include education on OSA and CPAP, enhance patient acceptance of the treatment, and provide continual support and education, encouraging long-term adherence [1].

Intense educational programmes, mask fitting and a familiarisation session with CPAP prior to CPAP titration also increase adherence [2, 3, 5, 17, 18]. Training by a sleep specialist or nurse coupled with a video depicting information on OSA, symptoms, health consequences and

Educational questions

1. What are the characteristics of Type D personality?
   a) Relaxed, easy going and prone to few health concerns
   b) Usually stressed, negative emotions, social inhibition and fear of rejection/disapproval of others
   c) Highly strung, organised and unwilling to change or adapt to new situations
   d) A mix between Type A (organised) and Type B (relaxed)
2. What are the characteristics of those who are compliant with continuous positive airway pressure (CPAP)?
   a) Relaxed, easy going and prone to few health concerns
   b) Usually stressed, unable to cope with everyday problems and having an overly involved partner
   c) Negative emotions, social inhibition and introverted
   d) High internal locus of control, high self-efficacy and active coping skills
3. What can specialists/doctors do to increase CPAP adherence?
   a) Wait 4 weeks after giving CPAP and check with the patient
   b) Use a personality inventory, coping skills questionnaire, educational programmes/sessions and giving information booklets
   c) Stress the importance of CPAP but if a patient is not going to use the machine, there is little that can be done
   d) Introduce a CPAP compliance smartphone app into the patient's care plan
4. How can partners affect CPAP adherence?
   a) Supporting/reinforcing the patient's desire to use CPAP increases adherence
   b) Partners who complain about the noise the CPAP machine emits decrease CPAP adherence
   c) Partners who come to the doctor's appointments with the patient increase CPAP asherence
   d) Partners who make doctor's appointments for the patient decrease CPAP adherence

Suggested answers

1. b.
2. d.
3. b.
4. d.

pathophysiology, as well as what a CPAP machine is, how to use it and the benefits of CPAP, should all take place before the patient goes home with the machine. By alerting the patient to the medical and daytime consequences (*e.g.* weight gain and EDS) of untreated OSA, highlighting the advantages of the treatment (*e.g.* relationship improvement), downplaying the disadvantages, and stressing the consequences of nonadherence, adherence to CPAP actually increases [6]. Patients should be given a take-home booklet with this information to refer to as necessary and given ongoing education after each clinical visit. There is evidence that providing literature that outlines the value and importance of regular CPAP use increases nightly use by 2.7 more hours a night [1].

If the patient has a Type D personality, early intervention within the first few days of commencing CPAP therapy using cognitive behavioural therapy (CBT), Motivational Enhancement Therapy or motivational interviewing intervention provides coping skills, improves self-efficacy and provides a positive view of the treatment [17, 19, 20]. Type D patients do not effectively cope with stressful life events; therefore, psychological interventions (*e.g.* CBT) focusing on training and teaching coping skills to decrease stress and increase disease management skills not only benefit the patient, but also increase CPAP use by 2.7–3.2 h a night [1, 5, 9]. Social support groups improve adherence by increasing positive emotions associated with treatment, peer motivation to continue using CPAP long-term [1, 4, 5] and provide coping skills/self-management tools among peers [5].

An important aspect of predicting compliance is to evaluate the perception of symptoms and improvement of those with Type D since these individuals tend to perseverate on the perception of symptoms or side-effects [5]. Therefore, another critical component to increasing adherence is providing nursing support and follow-up phone calls, particularly during the first month of CPAP use [18, 21]. These troubleshooting telephone calls have a positive impact, increasing CPAP use by >1.4 h a night [1]. Telemonitoring (*e.g.* talking with the patient *via* Skype instead of in person) also improves CPAP adherence and decreases depressive symptoms [22]. This support, coupled with patient visits to the sleep centre will provide immediate troubleshooting as well as detect early patterns of CPAP use, allowing further intervention if necessary [1, 5, 18, 21]. It is recommended these follow-up phone calls and clinical visits should be within the first few days after treatment has commenced, and then again after 6 weeks, 3 months, 6 months and then yearly [5]. Well-designed patient-educational and support programmes coupled with follow-up visits and phone calls can lead to superior adherence of 84% with ≥4 h a night [5, 23].

Lastly, enlisting the support of a significant other is a potential factor that can increase CPAP adherence [1, 5], as CPAP use positively affects relationship quality. Partners should be encouraged to allow the patient to make their own appointments, as adherence increases when patients feel they have a sense of self-control over their disease. While personality type is an important factor to consider in the management of OSA patients, interventions focusing on lifestyle (diet and exercise) could also improve mood, wellbeing and, potentially, CPAP compliance [24]. A comprehensive strategy should be aimed for in all OSA patients.

Most of the studies to date on CPAP adherence and personality have used small sample sizes or are case studies, and have not investigated Type A (organised, anxious) or Type B (relaxed, creative) personality types in this population. CPAP treatment compliance is imperative to decrease mortality rates, decrease economic costs, and increase the quality of life of individuals with OSA and their families. There is a need for more research in understanding and targeting interventions aimed at psychosocial predictors of CPAP adherence, and developing better, more effective and bespoke treatment plans. Since personality traits are not stable and can transform over time after use of an intervention or positive experiences, more research is warranted focusing on cognitive variables [2, 5, 11]. For example, there have not been any studies investigating the change in MMPI scores after CPAP use has been initiated and maintained. Further investigation is necessary to understand how health professionals can increase CPAP adherence and empower patients to deal with their own disease.

Conflict of interest

None declared.

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