▪ Headache Medicine 2025, 16(4):200-208 ▪ p-ISSN 2178-7468, e-ISSN 2763-6178

Headache Medicine

▪ DOI: 10.48208/HeadacheMed.2025.33

Review

Morning headache in sleep apnea and the response to continuous positive airway pressure treatment: a systematic review

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Edited by:
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Introduction
There is a strong association between Obstructive Sleep Apnea (OSA) and headache. Recently, morning headache has been suggested as part of the clinical findings of OSA, and is currently listed in the third edition of the International Classification of Headache Disorders under the title sleep apnea headache. It is defined as recurrent morning headache with an Apnea-Hypopnea Index (AHI) greater than or equal to 5, verified by polysomnography, and headache cessation within 72 hours of effective sleep apnea treatment. The use of continuous positive airway pressure (CPAP) for the treatment of OSA and, consequently, for morning headache, is well established, although some studies do not demonstrate this association.

Objective
The objective of this study is to systematically review the evidence on the effectiveness of CPAP in the treatment of morning headache in individuals with sleep apnea syndrome, observing the headache characteristics, side effects, and benefits of therapy.

Methods
This is a systematic review of scientific articles published up to June 2024 using the electronic platforms: PubMed, Cochrane Library, SciELO, and LILACS.

Results
Of the 308 articles found, seven studies were selected because they met the inclusion criteria. The selected articles include one randomized clinical trial, four prospective observational studies, one cross-sectional study, and one retrospective study. All articles highlighted the relationship of morning headache as a common symptom in patients with OSA and demonstrated some degree of symptom improvement after CPAP treatment.

Conclusions
This systematic review demonstrates a growing body of evidence consistently supporting the beneficial effect of CPAP in the treatment of morning headache in patients with OSA. Given the potential presented, but limited by the scarcity of high-quality articles, more controlled studies are needed to establish and standardize the clinical use of the method for this purpose.

Keywords:
Morning headache
Sleep apnea headache
Obstructive sleep apnea
CPAP
Systematic review

Received: October 10, 2025
Revised: November 21, 2025
Accepted: December 18, 2025

Introduction

Obstructive sleep apnea (OSA) is a clinical entity recognized by the International Classification of Sleep Disorders and is characterized by a chronic disorder that interrupts breathing during sleep (1). It can affect people of any age and its severity varies. This interruption or decrease in breathing is the result of repetitive, partial, or complete airway obstructions (2). According to the American Academy of Sleep Manual, apnea consists of a reduction of 90% or greater in oronasal airflow for a period longer than 10 seconds, while hypopnea is represented by a reduction of 30% or greater in nasal airflow for a period longer than 10 seconds, associated with desaturation of 3% or greater or with awakening (3).

These respiratory interruptions can result in nocturnal awakenings or prevent deep, restful sleep, leading to shallow, fragmented sleep. The most common consequences are fatigue and daytime sleepiness. The greatest impact of OSA, however, has been its association with increased morbidity and mortality rates, decreased quality of life, and an increased risk of various health problems, such as atrial fibrillation, depression, stroke, coronary artery disease, hypertension, and diabetes mellitus (4).

Clinical features of OSA include wheezing observed during sleep, morning headache, excessive daytime sleepiness, loud snoring, and increased neck circumference (5,6), but its diagnosis is made through baseline polysomnography.

In baseline polysomnography, the most commonly used parameter in the diagnosis of OSA is the apnea-hypopnea index (AHI), which is calculated by adding all apneas and hypopneas and then dividing by the total sleep time. An apnea-hypopnea index of 15 or more events per hour, or five or more events per hour in the presence of cardiovascular symptoms or comorbidities, confirms the diagnosis of OSA (7). OSA is classified as mild when the AHI is between 5 and 15 events per hour of sleep, moderate when the AHI is between 15 and 30 events per hour of sleep, and severe when the AHI is greater than 30 events per hour of sleep (8,9).

The exact prevalence of OSA is unknown, although estimates range from 2 to 14% in community-screened populations, to a much higher prevalence in certain subgroups (20 to 90% of people referred for sleep studies) (10).

Men are three times more likely than women to have OSA. It is particularly uncommon in non-obese and premenopausal women, however, the rate of OSA in postmenopausal women not taking hormone therapy approaches the rate of OSA in men of similar age and body mass index (5,11).

There is a strong association between OSA and headache. Consequently, a direct relationship between these clinical entities is highlighted by the presence of a condition called "sleep apnea headache," described in the third edition of the International Classification of Headache Disorders. Sleep apnea headache is defined as a recurrent morning headache with an AHI greater than or equal to 5, as verified by polysomnography, that resolves within 72 hours after effective treatment of sleep apnea (12).

The prevalence of morning headache has been reported in patients with OSA, with rates ranging from 15% to 60%, (13) and the mechanisms by which it occurs in these patients have not yet been definitively identified. Hypoxia has traditionally been implicated as a factor influencing headache; however, studies investigating this relationship have reported conflicting results (14) Other factors such as hypercapnia, impaired cerebral blood flow autoregulation, transient increases in intracranial pressure, and sleep fragmentation have also been postulated (15,16).

Furthermore, the characteristics of morning headache have not been clearly described. In the literature, only scant data evaluating the characteristics of morning headache in OSA are found, and they report nonspecific symptoms, making standardization difficult. (17,18).

Positive pressure therapies include continuous positive airway pressure (CPAP), bilevel positive airway pressure (BiPAP), and auto-titrated positive airway pressure (APAP). CPAP has proven effective and remains the first-line treatment for OSA. The biggest impediment to its use is adaptation to the device. The CPAP adherence rate ranges from 17% to 85%, with adherence improving when patients receive early and continued education and support regarding CPAP use (19,20).

For patients with mild apnea or who have not tolerated CPAP, oral appliances are a reasonable alternative. The two main oral appliance therapies are mandibular advancement devices, which hold the patient's jaw forward to maintain an open airway, and tongue-retaining devices (21). Despite, in terms of efficacy, CPAP has been shown to be superior to oral appliances in reducing apnea-hypopnea indices, arousal indices, and oxygen desaturation , particularly in patients with moderate to severe OSA, although quality of life indices appear to be similar to those of oral appliances (22).

CPAP has not only been shown to improve quality of life and sleep in patients with OSA, but also to reduce blood pressure, arrhythmia and stroke rates; improve left ventricular ejection fraction in patients with heart failure; and improve rates of fatal and non-fatal cardiovascular events (23).

Although there is robust evidence in the literature demonstrating that CPAP improves AHI, the results of this therapy in improving pain in OSA patients with chronic pain are still unknown. A systematic review suggests that CPAP was effective in improving headache frequency, duration, and intensity and supports its use for both morning headache and other types of chronic headache (24). Other studies have shown that CPAP-treated morning headache associated with OSA results in almost complete resolution within one month (25) and that continuous nasal positive airway pressure can lead to complete remission of morning headache in 90% of cases (26).

The objective of this study is to systematically review the evidence on the effectiveness of using continuous positive airway pressure. airlines (CPAP) in the treatment of morning headache in individuals with Obstructive Sleep Apnea, observing the characteristics of the headache, side effects and benefits of the therapy.

Methods

Type of study

This is a systematic review of scientific articles published in national and international literature. The references used for the study were based on the guidelines contained in the PRISMA statement (27) and the Cochrane handbook for systematic reviews of interventions (28).

Eligibility criteria

The inclusion criteria adopted in this review were: studies that addressed morning headache in adult patients over 18 years of age diagnosed with Obstructive Sleep Apnea and who underwent treatment with Continuous Positive Airway Pressure (CPAP). Publications with full text available of randomized and non-randomized clinical trials, prospective cohorts, and case reports were considered.

The exclusion criteria adopted were: articles that addressed a topic unrelated to the objective of the study; patients without a confirmed diagnosis of Obstructive Sleep Apnea; chronic headache unrelated to sleep apnea; literature reviews; articles that did not address treatment with positive pressure therapy; articles that did not evaluate the response to treatment of morning headache; and incomplete articles.

The primary outcome was the assessment of the response to treatment of morning headache after CPAP use in relation to pain intensity and frequency. There were no restrictions on secondary outcomes.

Databases

Electronic platforms were used: PubMed, Cochrane Library, Latin American and Caribbean Literature in Health Sciences (LILACS) and Scientific Electronic Library Online (SciELO) to search for scientific articles published up to June 2024.

Search strategy

Various combinations of the following descriptors were used to search for articles: “Sleep Apnea”, “Headache”, “Continuous Positive Airway Pressure”, “Morning Headache”, "Obstructive Sleep Apnea", “Headache”, “Morning Headache”, “Headache”, “CPAP” and “Continuous Positive Airway Pressure”. The Boolean operator "AND" was used in the search system to relate the terms.

Study screening

Based on the results obtained, the following was carried out screening of studies found through analysis of the title and abstract by two independent reviewers (GRSK, BSB) to assess whether or not they are suitable for the research object.

Articles focusing on the treatment of morning headache after CPAP use in patients with obstructive sleep apnea syndrome were fully evaluated, and their data were extracted using a standardized form among researchers to document the following information: sample characteristics, study design, headache pattern, intensity, and frequency, associated symptoms, CPAP efficacy, safety, and adverse events, as well as the duration of therapy effects after treatment in these patients. Review articles, duplicate articles, and unrelated articles were excluded (Figure 1).

Results

Study selection

A total of 308 articles were identified in the databases. These articles underwent a manual review process by the researchers, and 135 were removed during screening due to duplicates, leaving 173 articles. These articles had their titles and abstracts evaluated by two independent researchers, and 155 publications were removed from the study because they met the exclusion criteria.

The full texts of the remaining 18 articles were individually assessed by the researchers for eligibility criteria. Of these, 11 were excluded at this stage: 5 due to failure

to individualize the data related to morning headache, which was necessary for evaluation and comparison between publications in this study; 4 because they addressed other headaches, 3 of which were cluster headache and 1, headache secondary to cerebral venous thrombosis; and, finally, 2 articles were excluded because they did not address CPAP treatment.

After selection, 7 articles were included for final analysis, namely: Adler et al. (29), Basoglu et al. (30), Cruz et al. (31), Goksan et al. (26), Neau et al.(17), Seo et al. (32) and Suzuki et al. (33).

The entire study selection process is described in Figure 1 in the flow diagram suggested by the PRISMA statement.

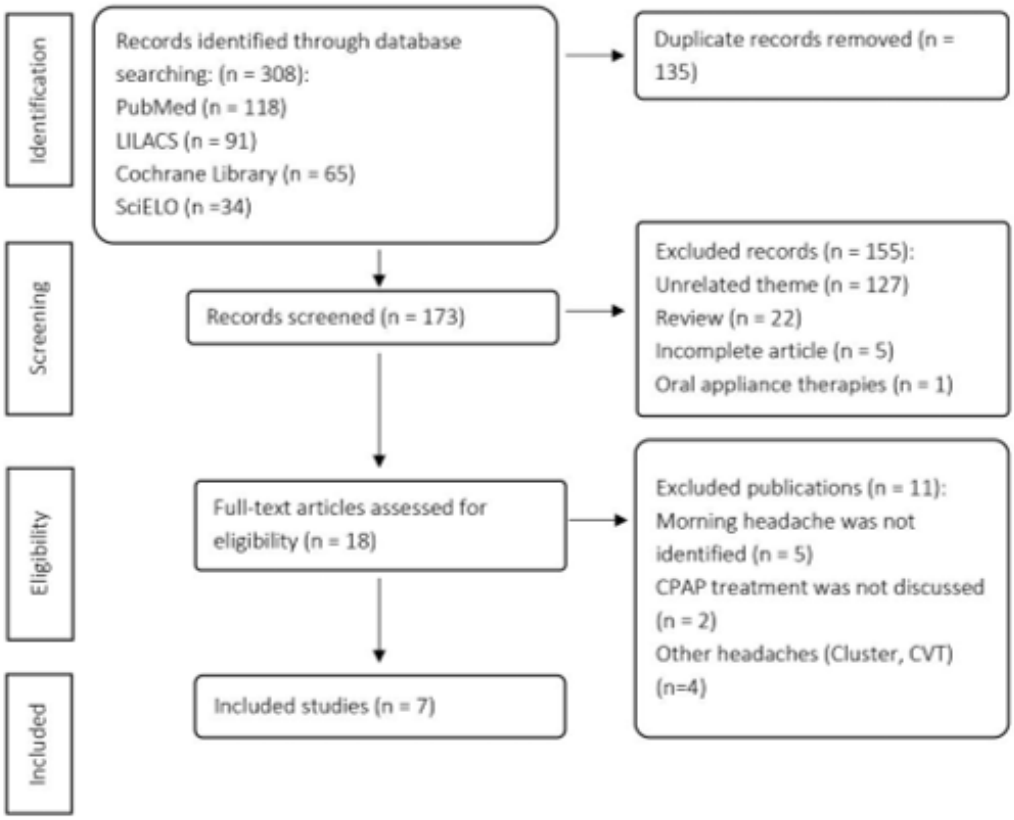

Figure 1. Flow diagram PRISM

Characteristics of the studies

The main characteristics of the studies in this review are summarized in Table 1. Of the seven selected articles, there is one randomized clinical trial, four prospective observational studies, one cross-sectional study and one retrospective study.

Table 1. Differential diagnosis and clinical characteristics

References	Type of study	Participants (n, age, gender, BMI)	Basal AHI	AHI after CPAP	Symptoms before CPAP treatment	Symptoms after CPAP treatment	CPAP adherence (average)	Follow-up (days)	Secondary outcomes	Conclusion
Adler et al. (2021)	Prospective observational study	OSA: n = 5,566 / Age: 57.4 [49;65.1] / Gender: 4,022 male / 1,544 female / BMI: 31.6 [27.8;36.1]	OSA: AHI: 39 [30;56.4]	OSA: AHI 2.7 [1.3; 5]	OSA: Morning headache: 39.1%, Nocturia: 63.6%, Daytime sleepiness: 86.2%, Erectile dysfunction: 25%	OSA: Morning headache: 21.3%, Nocturia: 39.7%, Daytime sleepiness: 48.2%, Erectile dysfunction: 18.1%	OSA: 6h	OSA: 0 and 517 days	ESS OSA Baseline: 10 Follow-up: 6	CPAP therapy was effective in normalizing AHI and is associated with an overall improvement in OSA-related symptoms.
		Overlap: n = 754 / Age: 64.1 [56.6;71.4] / Gender: 616 male / 138 female / BMI: 31.6 [27.9;36.6]	Overlap: AHI: 41 [32;59]	Overlap: AHI 3 [1.5; 5.1]	Overlap: Morning headache: 32.9%, Nocturia: 72.9%, Daytime sleepiness: 88.6%, Erectile dysfunction: 30.9%	Overlap: Morning headache: 22.9%, Nocturia: 52.4%, Daytime sleepiness: 53.2%, Erectile dysfunction: 22.1%	Overlap: 6h	Ovelap: 0 and 536 days		
Basoglu et al. (2011)	Randomized Clinical Trial	Video: n = 66 / Age: 53.7 +/- 10.8 / Gender: 54 male / 12 female / BMI: 33.2 +/- 7.4	Video: AHI 61.2 +/- 26.3	Adherents: AHI 57.7 +/- 25.4	Morning headache, witnessed apnea, night sweats, dry mouth, daytime drowsiness	Video: Significant improvement in symptoms after using CPAP	4 hours per night for at least 70% of nights	30, 90 and 180 days	ESS video: baseline: 10.3 6-month follow-up: 3.8	All OSA-related symptoms improved more significantly in patients adherent to CPAP therapy
		Control: n = 67 / Age: 54.4 +/- 10.7 / Gender: 47 male / 20 female / BMI: 32.9 +/- 5.7	Control: AHI: 57.4 +/- 24.2	Non-adherent: AHI 62.2 +/- 24.9					ESS control: baseline: 12.4 6-month follow-up: 4.4	
Cruz et al. (2011)	Prospective Study	n = 98 / Age: 55.1 [22;74] / Gender: 98 male / BMI: 33.3 +/- 4.9	AHI: 52.2 [20.2;105.8]	_	Morning headache 10%, nocturia 38%, night sweats 34%, gasping 30%, erectile dysfunction 25%, fatigue 23%, heartburn 15%	Morning headache 3%, nocturia 24%, night sweats 12%, gasping 2%, erectile dysfunction 18%, fatigue 2%, heartburn 1%	5.9 hours per night for 171.2 days of use, representing 88.5% use	0 and 180 days	ESS Pre CPAP: 12.3 ESS Post CPAP: 5.0	After 6 months of APAP therapy, a statistically significant reduction in the prevalence of all symptoms except morning headache and erectile dysfunction was observed.
Goksan et al. (2009)	Prospective observational study	OSA: n = 462 / Age: 50.9 +/- 11.4 / Gender: 347 male / 115 female / BMI: -	OSA with morning headache: AHI 38.7 +/- 25.7	_	OSA: Morning headache: 33.6%	Morning headache disappeared completely after 1 day in 55 (72.4%), after 7 days in 64 (84.2%) and after 30 days in 70 (92.1%)	-	1, 7 and 30 days	-	Morning headache was more prevalent in OSA and increased with OSA severity. The effectiveness of CPAP treatment in patients with morning headache has been clearly demonstrated.
		Control: n = 101 / Age: 47.2 +/- 11.9 / Gender: 69 male / 32 female / BMI: -	OSA without morning headache: AHI 34.1 +/- 24.6		Control: Morning headache: 8.9%					
Neau et al. (2022)	Prospective Study	OSA: n = 164 / Age: 54 +/- 10.7 / Gender: 144 male / 20 female / BMI: 31.5 +/- 6.4	AOS: IAH 46.1 +/- 23.7 [15;112]	_	OSA: Morning headache: 18.9%	Did not individualize morning headache	-	_	Depression was significantly correlated with headache and CPAP treatment could lead to a significant improvement in depression	It is suggested that more than two-thirds of patients with headache and OSA will be relieved with CPAP, so clinical signs of OSA should be investigated among patients with chronic headaches.
		Snorers: n = 148 / Age: 48.9 +/- 10.1 / Gender: 112 male / 36 female / BMI: 28.4 +/- 5.9	Snorers: AHI 5.2 +/- 4.5 [0;14]		Snorers: Morning headache: 16.2%	None used CPAP				
Seo et al. (2023)	Retrospective study	Severe OSA: n = 74 / Age: 49.27 +/- 10.7 / Gender: 66 male / 8 female / BMI: 29 +/- 4.53	Severe OSA: AHI 58.45 +/- 19.39	_	Severe OSA: Morning headache: 59.5%	Overall improvement from 53.4% to 16.4% in the prevalence of morning headache after CPAP	4 hours per night for at least 70% of nights	0 and 90 days	Daytime sleepiness was significantly associated with morning headache and there was a significant correlation between the improvement of both after PAP treatment	Short-term PAP therapy may improve morning headache in adults in up to 72% of patients with severe OSA.
		Mild to moderate OSA: n = 42 / Age: 52.24 +/- 9.16 / Gender: 37 male / 5 female / BMI: 26.23 +/- 2.83	Mild to moderate OSA: AHI 18.41 +/- 6.59		Mild to moderate OSA: Morning headache: 42.9%					
Suzuki et al. (2015)	Cross-sectional study	With sleep apnea headache: n = 39 / Age: 49.3 +/- 10.1 / Gender: 30 male / 9 female / BMI: 31.5 +/- 9	With sleep apnea headache: AHI 56.6 +/- 24.9	With sleep apnea headache: AHI 3.6 +/- 2.5	Morning headache: 20.4%	81.3% reported improvement in morning headache after CPAP treatment	4 hours per night	29.2 +/- 28 months	-	CPAP therapy can effectively treat morning headaches. The cause of sleep apnea headaches remains to be elucidated.
		No sleep apnea headache: : n = 196 / Age: 55.9 +/- 11.6 / Gender: 160 male / 36 female / BMI: 28.1 +/- 7.4	Without sleep apnea headache: AHI 54.5 +/- 24.9	Without sleep apnea headache: AHI 3.7 +/- 2.4				36.8 +/- 29.2 months		

n: number; AHI: Apnea-Hypopnea Index; OSA: Obstructive Sleep Apnea

A total of 6,774 patients with a confirmed diagnosis of Obstructive Sleep Apnea were evaluated in the selected studies. From an epidemiological point of view, a higher prevalence of OSA was demonstrated in men, with a mean age between 49.3 and 57.4 years and a Body Mass Index (BMI) between 28.1 and 33.3.

All studies evaluated the baseline AHI of patients. Patients with isolated OSA who complained of morning headache had a higher AHI compared to the other patients evaluated in the study, except in Adler et al. (29), in which the comparison group had a higher AHI; however, this group was not composed of healthy control patients, but of patients with overlap syndrome.

Only 3 studies compared the AHI in patients with OSA before and after treatment (Adler et al.(29), Basoglu et al. (30) and Suzuki et al.(33). These studies demonstrated that CPAP therapy was effective in reducing the index after treatment, and in Adler et al. (29) and Suzuki et al. (33) this reduction was able to lower the AHI to normal parameters.

All articles evaluated morning headache as a symptom in OSA patients and demonstrated symptom improvement after CPAP treatment. In Adler et al. study(29), CPAP therapy was effective in normalizing the AHI and was associated with an overall improvement in OSA-related symptoms, such as morning headache, nocturic headache, excessive daytime sleepiness, and erectile dysfunction. Basoglu et al.(30) concluded that all sleep apnea-related symptoms improved more significantly in patient's adherent to CPAP therapy, including morning headache, witnessed apnea, night sweats, dry mouth, and daytime sleepiness. In Goksan et al.(26) study, morning headache was more prevalent in OSA and increased with disease severity. The effectiveness of morning headache treatment after CPAP use was clearly demonstrated.

In Neau et al. study (17), of the 53 headache patients, 31 had morning headache, 2 were lost to follow-up, 28 were treated with CPAP, 4 with uvoloplasty, and 19 with dietary guidance. Considerable improvement in headache occurred in 36 patients (70.6%) after a few weeks, but was not correlated with any of the types of treatment, and the improvement in symptoms cannot be directly correlated with the use of CPAP.

In the work of Seo et al.(32) it was demonstrated that short-term CPAP therapy can improve morning headache in adults in up to 72% of patients with severe SAS.

Finally, Suzuki et al.(33) demonstrated an improvement reported by patients with morning headache of 81.3% after CPAP treatment.

In the Cruz et al.(31) study, patients using APAP were reevaluated after 6 months of therapy and a statistically significant reduction in the prevalence of symptoms such as nocturia, night sweats, gasping, and fatigue was observed. Although morning headache and erectile dysfunction did not show a statistically significant reduction, both improved with positive pressure therapy (10% to 3% for morning headache and 25% to 18% for erectile dysfunction).

Secondary outcomes

The main secondary outcomes evaluated in the studies presented were excessive daytime sleepiness, measured using the Epworth Sleepiness Scale (ESS), depression, and daytime fatigue. The studies of Adler et al.(29), Basoglu et al.(30) and Cruz et al.(31) made this comparison possible objectively through the ESS score before and after CPAP treatment, while the other studies evaluated did not describe these variables.

According to Adler et al.(29), the CPAP treatment had a major favorable effect on specific scales for daytime, excessive sleepiness (Epworth Sleepiness Scale [ESS]), daytime fatigue (Pichot scale) and depression (Pichot scale) in both groups (OSA and overlap). The ESS in OSA group at baseline was 10 and improved after follow-up to 6 (29).

Significant improvements in most of the OSAS symptoms and excessive daytime sleepiness were also seen in the adherent patients at all follow-up visits in the study of Basoglu et al.(30). Besides, ESS was negatively correlated by the duration of CPAP use. The ESS of video group at baseline was 10.3 and after 6-month follow-up was 3.8 while the baseline ESS of the control group was 12.4 and after 6 months of follow-up decreased to 4,4 (30).

In the study of Cruz et al.(31), a significant mean reduction of the ESS on more than 7 points ($p<0.001$) was verified. The ESS before CPAP was 12.3 and after CPAP therapy decreased to 5.0. They suggest that even in the absence of excessive daytime sleepiness, APAP therapy should be considered as it can the improve quality of life of non-sleepy OSA patients (31).

The relationship between daytime sleepiness and morning headache were also seen in Seo et al.(32). According to the authors, there is a significant correlation between the improvement of both after PAP treatment, although there is no objective description of this information.

In one study, a correlation between headache and depression was demonstrated. According to Neau et al.(17) depression was significantly correlated with headache and CPAP treatment could lead to a significant improvement in depression.

Discussion

All articles in this review demonstrated a higher prevalence of OSA in male individuals over the age of 50, as already established in the literature (24,34). However, it was not possible to establish a specific proportion in the prevalence between males and females due to the lack of standardization of the sample between the studies, and it was also not possible to evaluate the prevalence of OSA in postmenopausal women who do not use hormone therapy because it was not evaluated in the studies.

Morning headache is a very common complaint in patients with OSA. Several clinical studies have reported a prevalence of morning headache in patients with OSA of 15.2 to 74%. When we consider the prevalence of morning headache in the general population (5 to 7%), it can be suggested that OSA and morning headache are significantly associated (35). However, it is worth noting that morning headache is a nonspecific symptom of several sleep disorders and there is no strong evidence specifically associating OSA with the development of headaches (36), for this reason, Suzuki et al.(33) suggests that the cause of sleep apnea headache still needs to be better elucidated.

In this review, the prevalence of morning headache in patients with OSA ranged from 10% to 59.5% before CPAP treatment. Because of this strong association, Neau et al. (17) suggests that clinical signs of OSA should be investigated in patients with chronic headaches.

Another important point highlighted in our study was the significant improvement in morning headache after CPAP treatment. Nasal continuous positive airway pressure was able to lead to complete remission of morning headache in 90% of cases in Goksan (26), resulted in improvement in 81.3% of patients in Suzuki et al.(33), and was responsible for an overall reduction from 53.4% to 16.4% in the prevalence of morning headache in Seo et al.(32).

Studies indicate an association between morning headache and some parameters related to hypoxia in OSA (13,37). In a large population study (14), however, it was reported that medium and low levels of oxygen saturation during sleep were not significantly associated with the presence of morning headache, and in another study, it was shown that there was no relationship between headache and oxygen desaturation (38).

This review also failed to demonstrate any association between morning headache and nocturnal hypoxia. In Seo et al. (32), several polysomnographic parameters and demographic data were compared according to the presence of morning headache and found no difference between the group with mild to moderate OSA and the group with severe OSA. According to Neau et al.(17), it is likely that the role of hypoxia in sleep disturbances has been overestimated.

Although the evaluation of secondary outcomes was not universally performed among the studies and those that evaluated it did so in a non-standardized way, its results highlight the important correlation between excessive daytime sleepiness, excessive fatigue and depression in patients living with morning headache. The improvement of these variables, even if subjective, after the use of CPAP demonstrates how effective treatment can directly impact the functionality and quality of life of patients living with morning headache (17,29–32).

Limitations

This study has some limitations. The objective of this review was to systematically review the evidence on the effectiveness of CPAP in the treatment of morning headaches in individuals with sleep apnea, observing headache characteristics, side effects, and benefits of therapy. However, of the 308 articles identified in the databases, only 7 met the eligibility criteria, and only one of them was a randomized clinical trial.

The scarcity of high-quality studies that thoroughly investigate the use of CPAP in the treatment of morning headaches in individuals with sleep apnea, combined with the small number of patients recruited in these studies and the lack of standardization of the different parameters observed in each of these studies, are limiting factors that prevent an effective comparison and a comprehensive assessment of the use of CPAP for this purpose. The results presented, although positive, cannot be generalized.

An important limitation of the study was the lack of structured outcome measures, such as pain scales, quality-of-life instruments or sleep-related metrics that would allow an external comparison between the individual results found in the studies. The absence of the use of numerical scales to assess pain intensity before and after the use of CPAP also impaired this assessment.

Another limiting factor is the lack of information on patient follow-up time, the lack of medium- to long-term reassessment, and the failure to describe parameters related to CPAP adherence. These data are essential for understanding the true magnitude of CPAP's impact on morning headache treatment, as well as reducing the bias of non-response to treatment due to non-adherence. The study results also do not allow for conclusions about the long-term analgesic effect of CPAP, since most studies evaluated only short-term response and did not conduct longer-term follow-up.

Conclusions

This systematic review demonstrates a growing body of evidence consistently supporting the beneficial effect of CPAP in the treatment of morning headache in patients with OSA. All articles in this study evaluated morning headache as a symptom in OSA patients and demonstrated symptom improvement after some degree of CPAP treatment.

CPAP remains the cornerstone of Obstructive Sleep Apnea therapy and, consequently, morning headaches. However, adherence to treatment is a critical issue. Other methods, such as intraoral devices, have been used in selected cases, and the relationship between their use and the impact on morning headaches needs further study.

The pathophysiological mechanisms involved in the genesis of morning headache, although classically associated with hypoxia and its repercussions, still remain unknown and require further investigation, given the existence of several studies that have failed to prove this theory.

Given the potential presented, but limited by the paucity of high-quality articles, more controlled studies are needed to establish and standardize the clinical use of CPAP for this purpose.

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Authors' contributions: The study was developed by GRSK and BSB. Searches, selection of articles and review of eligibility were carried out by GRSK and BSB. Data extraction and analysis were conducted by GRSK and BSB. Critical evaluation of the results was performed by GRSK and BSB. The article was written by GRSK and BSB. Critical review of the article was done by GRSK and BSB.

Conflict of interest: There is no conflict of interest to declare.

Funding: None.