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Sleep Apnea: CPAP Adherence
What works? What doesn't? What's new?

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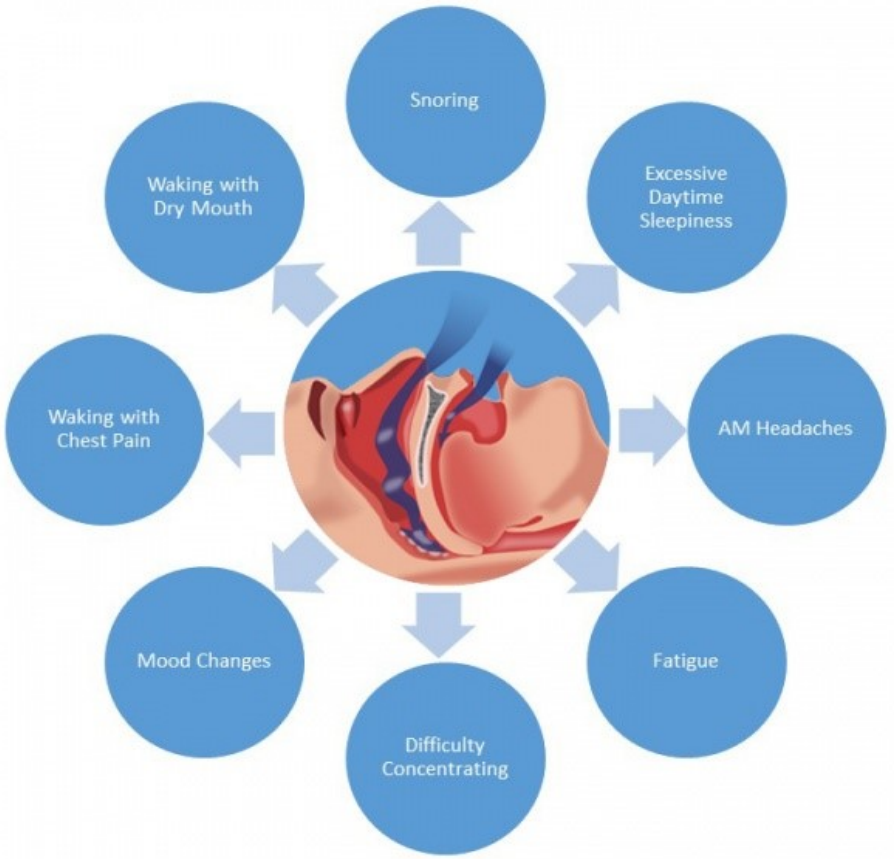
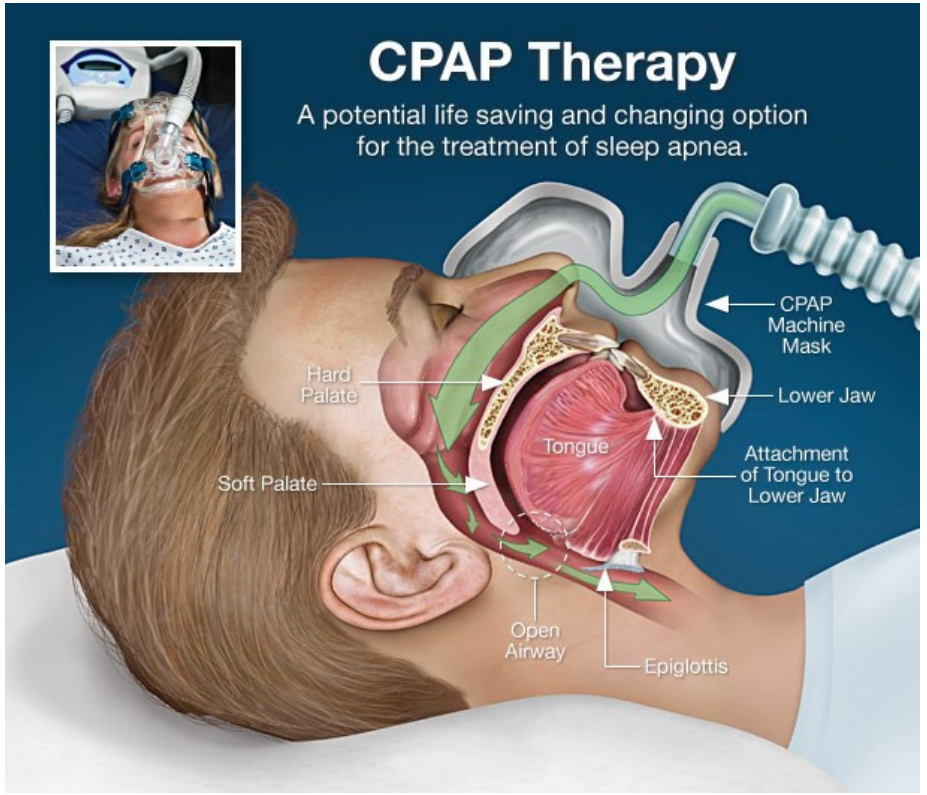
Obstructive Sleep Apnea

- **Obstructive sleep apnea (OSA)** is a disorder that is characterized by obstructive apneas and hypopneas due to repetitive collapse of the upper airway during sleep.



Obstructive Sleep Apnea

- Continue Positive Airway Pressure (CPAP) is an effective therapy for OSA, but adherence is frequently suboptimal



What is CPAP Adherence?

Defined as using CPAP for ***more than an average of 4 hours per night and more than 70 percent of nights (ie, more than five nights per week).***

What goal do we set:"CPAP should be used for a minimum of 4 hours per night for 5 to 7 nights a week"

Our advice to patients is to use it every night and throughout the night.

- Using less is better than never use
- It has been reported that even 1 hour of CPAP use per night reduces mortality.

Campos-Rodriguez F, et al. Chest 2005

CPAP Adherence Goals

- **The 4-hour cut-off** is typically used since several studies
- Four or more hours of CPAP use is associated with
  - **normalization of daytime sleepiness**
  - **improvement in quality of life,**
  - **improvement in neurocognitive function,**
  - **improvement in cardiovascular disease, and diabetes**
  - **a reduced risk of motor vehicle accidents**

Effects are typically felt within days to weeks of starting CPAP therapy.

Sawyer AM 2011, Weaver TE 2007, Zimmerman ME 2006, Antic NA 2011, Barbe F 2012, Bratton DJ 2014, Gervès-Pinquié C 2022

CPAP Adherence Goals

- **4 hours/ per night**
  - is sufficient to achieve a normal score on the **Epworth Sleepiness Scale**
- **6 hours /per night**
  - to achieve a normal level of objective alertness in the **Multiple Sleep Latency Test**
- **7.5 hours/per night**
  - to normal daytime functioning on the **Functional Outcomes of Sleep Questionnaire**
- **5 hours /per night**
  - improved **neurobehavioral performance**
- >**6 hours/** per night
  - improves **memory and daily functioning**

Craig SE 2012, Sawyer AM 2011, Weaver TE 2007, Zimmerman ME 2006, Antic NA 2011, Barbe F 2012,Bratton DJ 2014, Craig SE 2012

Prevalence of Nonadherence

Almost half of patients are nonadherent, (< 4 hours /per night)

The range is broad **(29 to 83 percent)**

Sawyer AM 2011,Weaver TE 2007, Zimmerman ME 2006, Antic NA 2011,
Barbe F 2012,Bratton DJ 2014,Craig SE 2012, Weaver TE 2008, Gay P 2006

The Impact of Nonadherence

The impact of nonadherence is typically felt within days to weeks of **stopping** CPAP therapy

Subtherapeutic CPAP ("CPAP withdrawal") led to **recurrence of abnormal respiratory events within one night**

Increased morning and evening blood pressure, morning heart rate, and subjective daytime sleepiness were seen **within two weeks of withdrawal.**

Kribbs NB, 1993, Grunstein RR 1996; Young LR 2013, Kohler M 2011

Risk Factors For Nonadherence

- Nonadherence is usually **multifactorial**
- **An adherence index** based upon polysomnographic indices has been described but is not validated or routine
- Nonadherence is often identified **during the first two weeks** of CPAP use and predicts long-term nonadherence.

Villa Alvarez J, 2022, Younes MK 2022, Pengo MF 2018, Turnbull CD 2016, Gulati A 2017,

Risk Factors For Nonadherence-First Two Weeks

- **Major predictors** of nonadherence during the **first two weeks**
  - **Higher residual AHI** (ie, poor efficacy of CPAP delivery)
  - **Poor self-efficacy**
    (defined as one's motivation, volition, and confidence to engage in a healthy behavior)
  - **Younger age** (weak association)
  - **Being African-American** (perhaps intertwined with lower socioeconomic status)

Villa Alvarez J, 2022, Younes MK 2022, Pengo MF 2018, Turnbull CD 2016, Gulati A 2017

Risk Factors For Long Term Nonadherence

- CPAP use <4 hours/night during the first two weeks of therapy
- **Problems encountered during the first night of use**
- Moderate to severe OSA
- **Certain psychological traits:**
  - *Lack of a positive perspective regarding the benefit of CPAP therapy and poor self-efficacy*
  - *Claustrophobic tendencies*
  - *Lack of ability to overcome obstacles and problem-solve*
- Unsupportive bed partner
- CPAP affecting sleep of bed partner
- Less severe oxyhemoglobin desaturation during sleep on diagnostic polysomnography
- Poor sleep-efficiency during CPAP titration (ie, time asleep/time in bed)
- Small nasal volume, nasal polyposis, and high nasal resistance
- Comorbid insomnia

Evaluation For Nonadherence

- **Frequent provider follow-up during first two weeks**
- Evaluate and manage nonadherence in the first two weeks of CPAP therapy
- And also re-evaluate at every follow up visit thereafter.
- **Assessment methods**
  - **in-person visits,**
  - **telephone call**
  - **telehealth encounters**

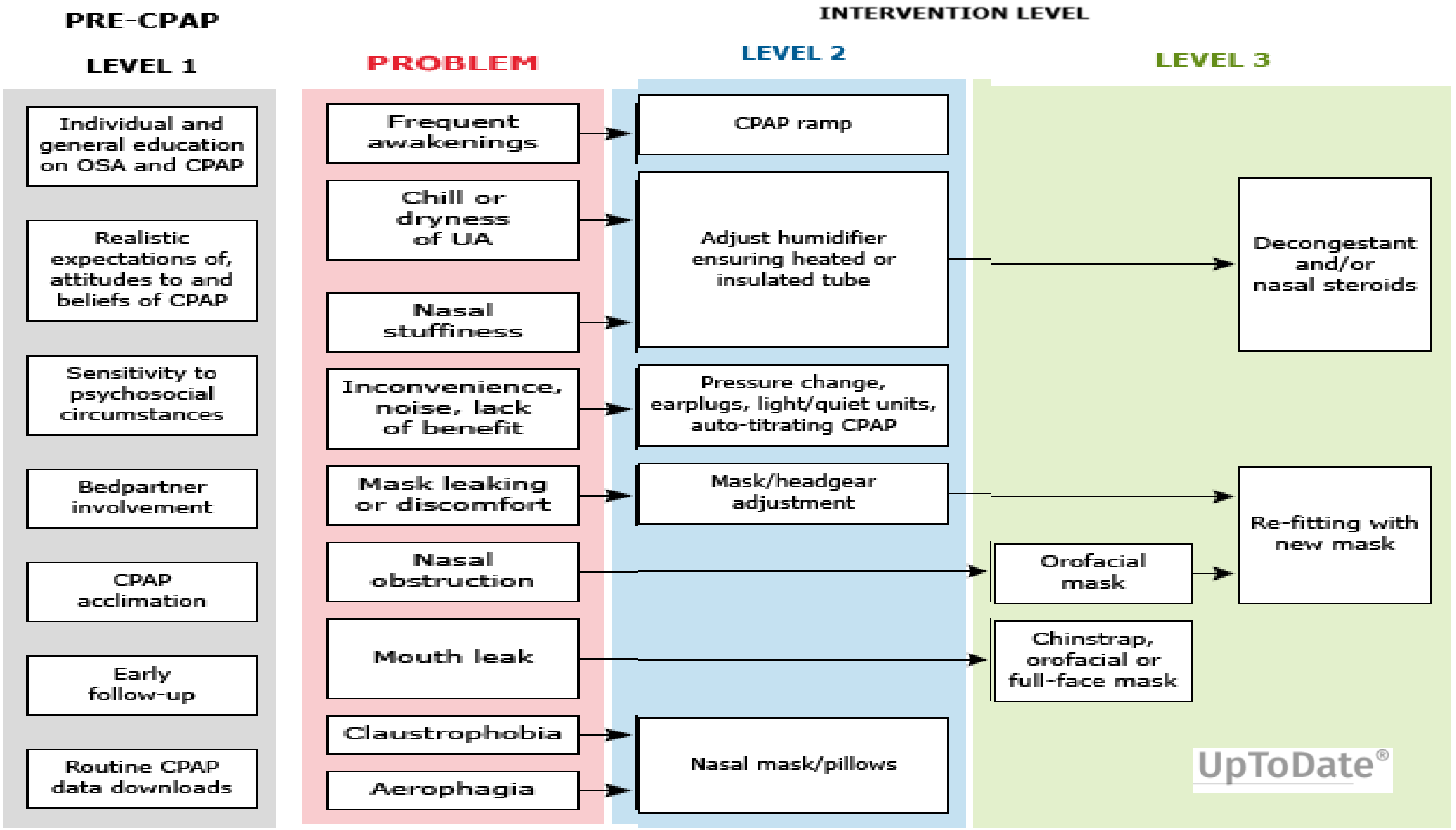
Evaluation For Nonadherence

- American Academy of Sleep Medicine recommends follow-up within **the first two weeks** to optimize adherence, then **monthly** and **yearly**, depending on level of adherence and resolution of symptoms.

Patil SP, J Clin Sleep Med 2019

Evaluation For Nonadherence

- **The evaluation should focus on the following:**
  - Determining whether or not the patient is tolerating CPAP therapy
  - The level of adherence, and perceived benefits
  - Identifying and troubleshooting any side effects
  - Offering general encouragement and reinforcement of the importance of nightly CPAP use


Multidisciplinary approach to managing CPAP-related problems
PRE-CPAP
LEVEL 1
INTERVENTION LEVEL
PROBLEM
LEVEL 2
LEVEL 3
Individual and general education on OSA and CPAP
Realistic expectations of, attitudes to and beliefs of CPAP
Sensitivity to psychosocial circumstances
Bedpartner involvement
CPAP acclimation
Early follow-up
Routine CPAP data downloads
Frequent awakenings
Chill or dryness of UA
Nasal stuffiness
Inconvenience, noise, lack of benefit
Mask leaking or discomfort
Nasal obstruction
Mouth leak
Claustrophobia
Aerophagia
CPAP ramp
Adjust humidifier ensuring heated or insulated tube
Pressure change, earplugs, light/quiet units, auto-titrating CPAP
Mask/headgear adjustment
Nasal mask/pillows
Decongestant and/or nasal steroids
Orofacial mask
Re-fitting with new mask
Chinstrap, orofacial or full-face mask
UpToDate®

Evaluation For Nonadherence

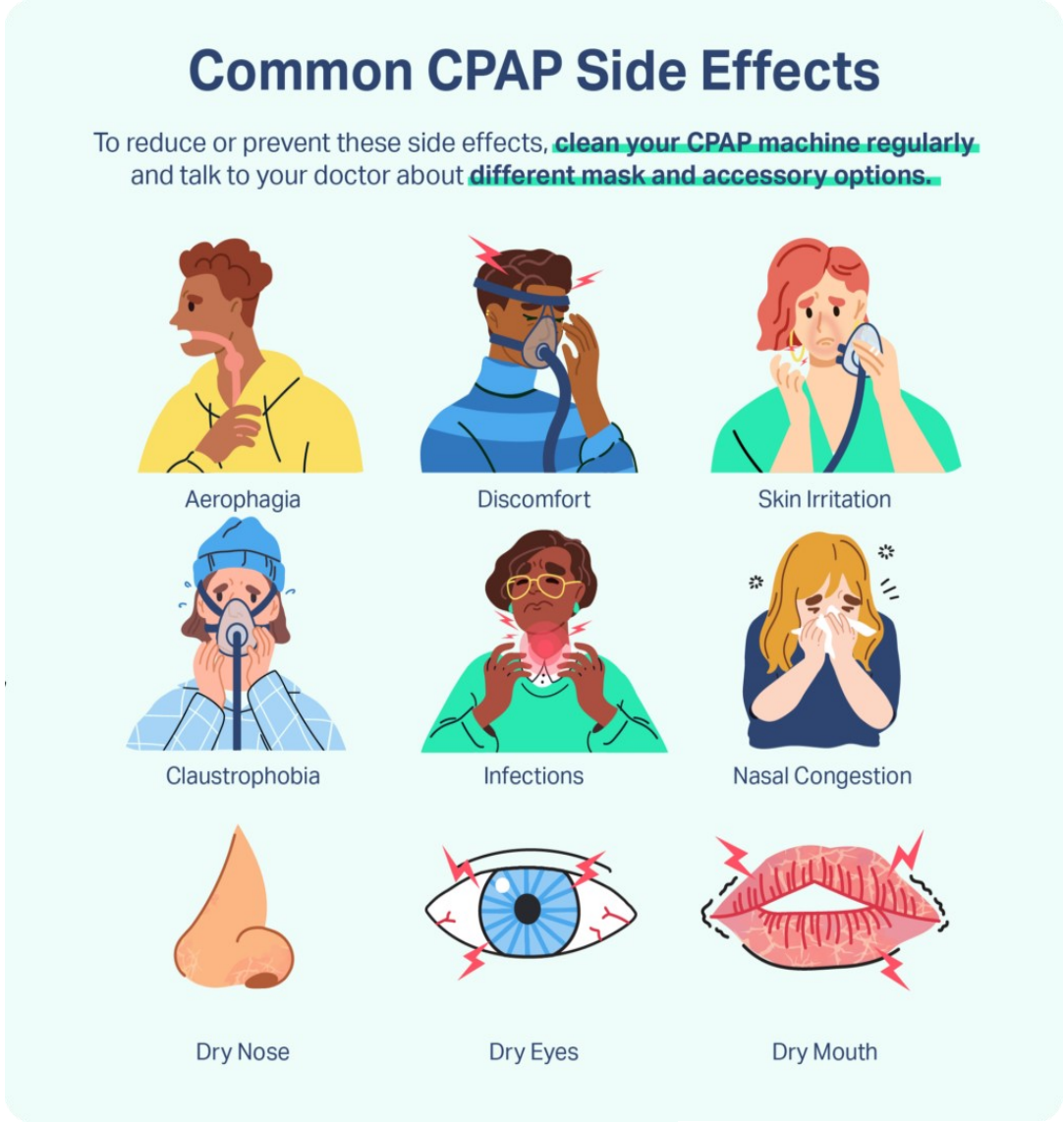
- **Multidisciplinary approach** is essential to evaluating and managing nonadherence.
- Effective teams consist of personnel experienced in sleep medicine including
  - ***a physician***
  - ***Technologist (electroneurophysiologist)***
  - ***advanced practice nurse, and psychologist***
  - ***the bed partner***
- Evaulation should be based on **Clinical and Objective Criteria**

Evaluation For Nonadherence/ Clinical Assessment Steps

1. Interviewing patients and their bed partner about their estimated hours of nightly use, frequency of weekly use

2. If nonadherence is present assess for side effects including

- **a sense of claustrophobia,**
- **mask-related ulceration,**
- **nasal or upper airway dryness or congestion,**
- **intolerance of the sensation of pressure or noise,**
- **frequent awakenings,**
- **mask discomfort and leak,**
- **aerophagia or nausea.**



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A OneCare Media Company

Evaluation For Nonadherence/ Clinical Assessment Steps

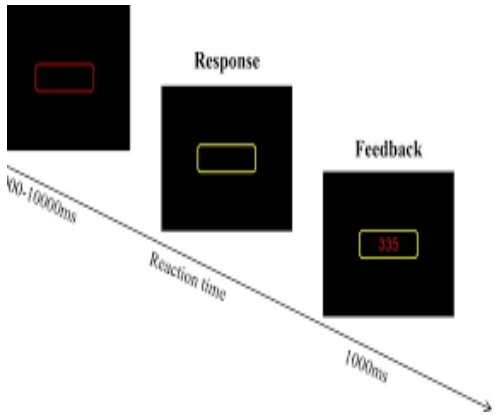
3. Question patients about their perception of **CPAP efficacy**

(eg, quality of sleep with CPAP, **daytime sleepiness, general daytime performance,** snoring and choking episodes during sleep, mood, motor vehicle accidents),

4. Question patients about the **impact of CPAP on their bed partner**

(eg, their quality of sleep and intimacy),

5. Assess the level of sleepiness on CPAP using either a self-report measure such as the ***Epworth Sleepiness Scale or an objective measure (eg, Psychomotor Vigilance Task).***



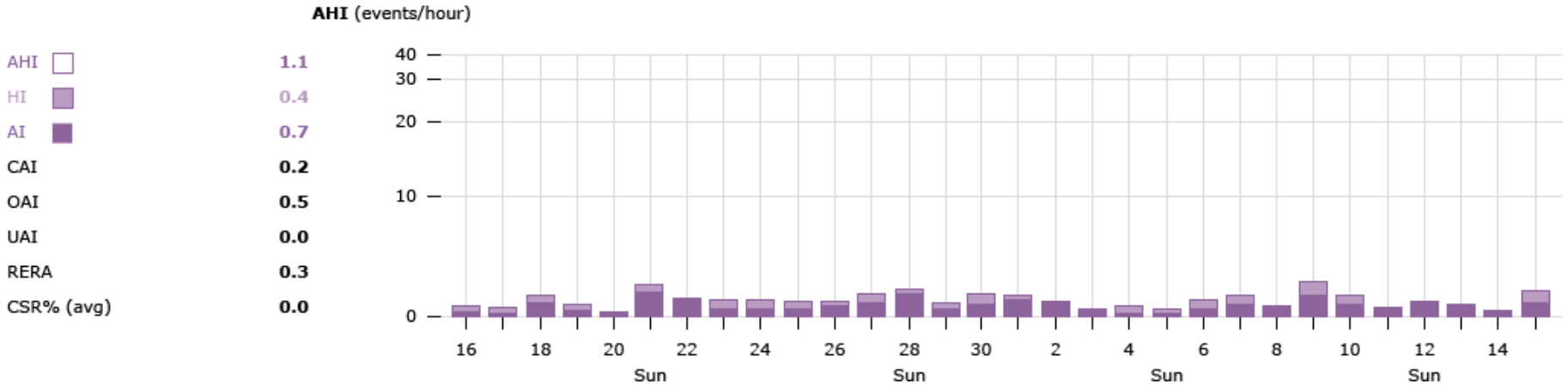
Evaluation For Nonadherence/Objective Assessment

1. Downloaded **data from the patient's CPAP device.**

Most newer devices contain ***data on***

- ***hours of "mask-on" use per day,***
- ***patterns of use (eg, how many nights per week CPAP was used for a certain duration),***
- ***mask leaks,***
- ***efficacy as measured by the device-measured apnea hypopnea index (AHI flow)***

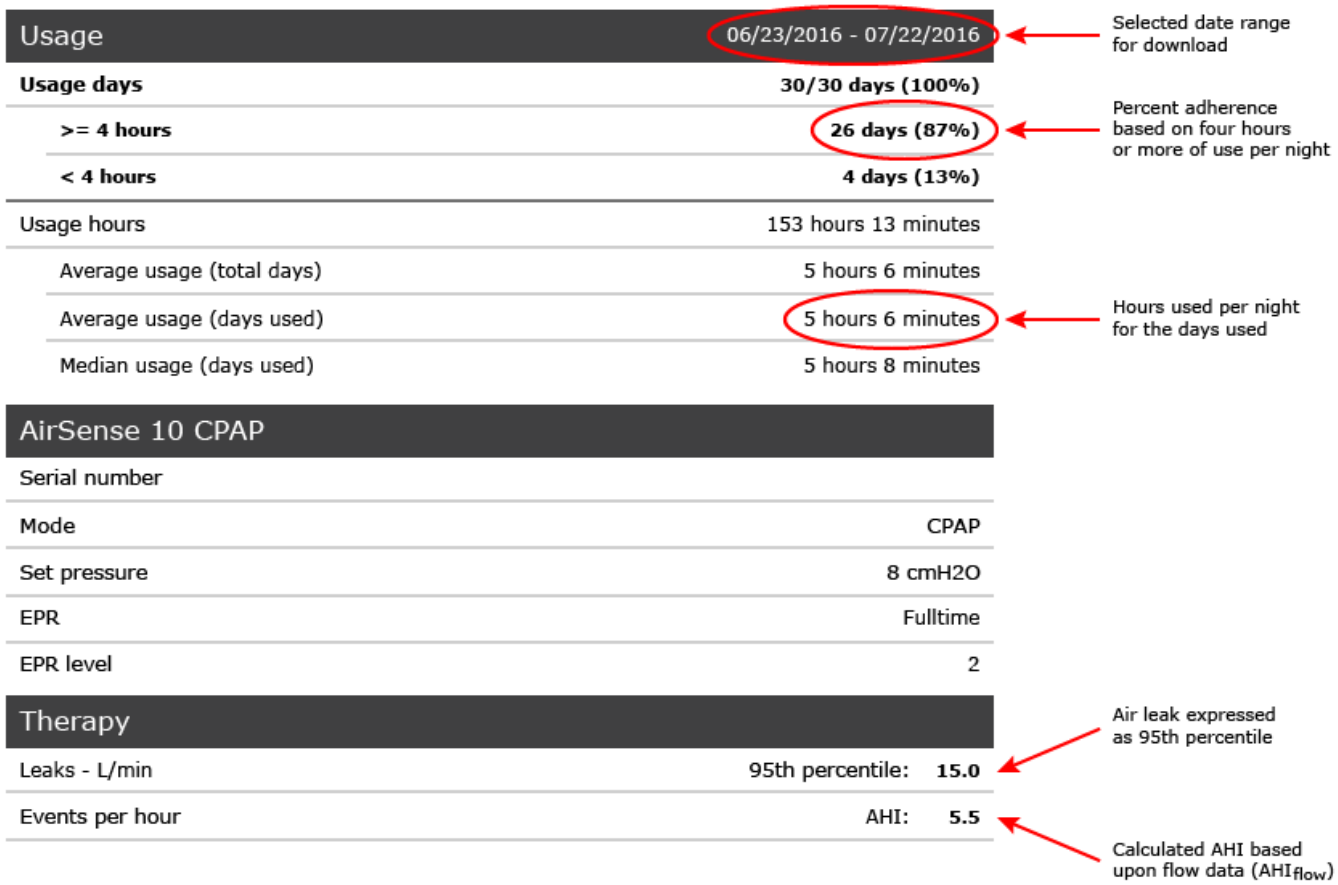
Apnea hypopnea index$_{flow}$ data



This graphic shows the breakdown of potential subtype of respiratory events reported as an index. In this case, the number of events in a one month period are low.

AHI: apnea hypopnea index (correctly referred to as AHI$_{flow}$); HI: hypopnea index; AI: apnea index; CAI: central apnea index; OAI: obstructive apnea index; UAI: unknown apnea index; RERA: respiratory effort related arousal; CSR% (avg): cheyne stokes respiration.

Device download: Adherence



Usage	06/23/2016 - 07/22/2016
Usage days	**30/30 days (100%)**
>= 4 hours	**26 days (87%)**
< 4 hours	**4 days (13%)**
Usage hours	153 hours 13 minutes
Average usage (total days)	5 hours 6 minutes
Average usage (days used)	5 hours 6 minutes
Median usage (days used)	5 hours 8 minutes

AirSense 10 CPAP	
Serial number	
Mode	CPAP
Set pressure	8 cmH2O
EPR	Fulltime
EPR level	2

Therapy		
Leaks - L/min	95th percentile:	**15.0**
Events per hour	AHI:	**5.5**

This graphic shows a typical format for downloaded information on adherence to CPAP over a select period.

CPAP: continuous positive airway pressure; EPR: expiratory pressure relief; EPR level: settings of 1 to 3 with 3 being the most pressure reduction; AHI: apnea hypopnea index.

Evaluation For Nonadherence/Objective Assessment

2. Telehealth

- Telehealth (eg, virtual visits, web-based educational tools, applications) is increasingly utilized to connect with CPAP users
- **In a meta-analysis of seven trials**, use of **patient-facing applications (PFAs)** was associated with improved CPAP adherence for significantly more hours per night

Shaughnessy GF, J Clin Sleep Med 2019

Evaluation For Nonadherence / Objective Assessment

3. Telemonitoring

Telemonitoring involves feedback that is given to the patient based upon data downloaded from the CPAP device. Studies have yielded conflicting results on the value of telemonitoring alone

4. Combined resources

In one trial, CPAP use at 90 days was higher in those who received telehealth education and telemonitoring web-based feedback compared with usual care **(4.8 versus 3.8 hours /night)**

Hwang D, Am J Respir Crit Care Med 2018

Evaluation For Nonadherence/Objective Assessment

5. Active patient engagement (APE)

- **Cloud-based technology** to promote adherence through patient engagement.
- This technology provides feedback on hours of CPAP use, presence of a leak, residual AHI
- One study reported that patients who accessed APE manufacturer cloud-based feedback services **used their CPAP one hour longer per night** compared with patients who did not (5.9 versus 4.9 hours/night)

Malhotra A, Chest 2018

What do we do if there is no adherence?

First-Line Intervention For Adherence

- Integrated approach that involves behavioral therapy and prompt management of side effects is usefull
- This approach has been shown to increase CPAP use by about one hour, sometimes more

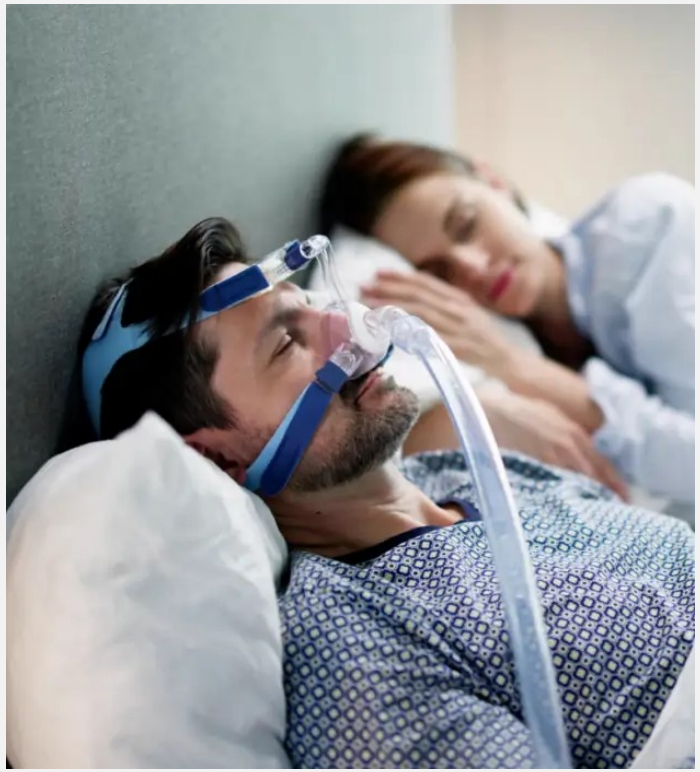
Askland K, Cochrane Database Syst Rev 2020

First-Line Intervention /Behavioral Therapy

- AASM suggest behavioral therapy to all patients with OSA being treated with CPAP, **before and during the first few weeks of therapy**.
- Therapies include
  - **Cognitive Behavioral Therapy (CBT)**
  - **Motivational Enhancement Therapy (MET).**
- Behavioral Therapy
  - can be delivered by a psychologist or advanced practice nurse.
  - can be performed during a telephone call or during an in-person or telehealth visit.

Patil SP, J Clin Sleep Med 2019

First-Line Intervention /Behavioral Therapy



- We encourage **support from a bed partner or significant other (CPAP "buddy),**
- Bed partner response to CPAP therapy also affects adherence
- Therapy is best administered before and during the **first month of starting** CPAP but can be offered at any time.

Askland K Cochrane Database Syst Rev 2020, Parthasarathy S J Clin Sleep Med 2013, Rotenberg BW J Otolaryngol Head Neck Surg 2016

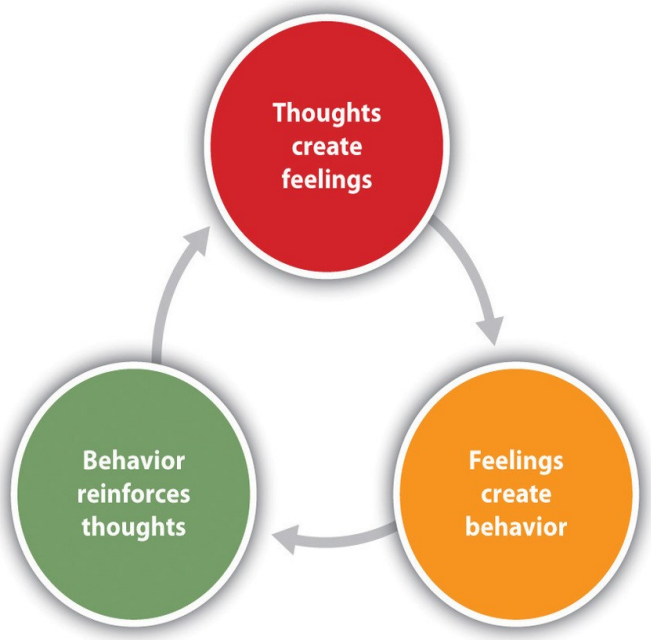
First-Line Intervention /Behavioral Therapy

- Behavioral interventions that focus on **intensive patient support and reinforcement of positive behaviors**, improve CPAP adherence by approximately **one hour per night**
- In a meta-analysis that included 41 small randomized trials of CPAP-naive patients with OSA, behavioral therapies were associated with **increased CPAP adherence (mean improvement 50 minutes per night)**
- Behavioral therapies improved CPAP adherence **by a mean of 1.3 hours per night**

Askland K Cochrane Database Syst Rev 2020, Parthasarathy S J Clin Sleep Med 2013, Rotenberg BW J Otolaryngol Head Neck Surg 2016

Cognitive Behavioral Therapy (CBT)

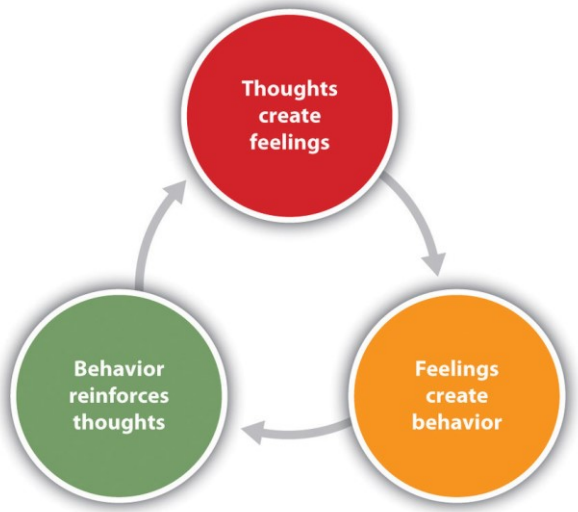
- The efficacy of **CBT plus education** has been reported in several randomized trials
- CBT is a structured psychotherapeutic method used to alter attitudes and behaviors.



Wong K, et al., Sleep 2007

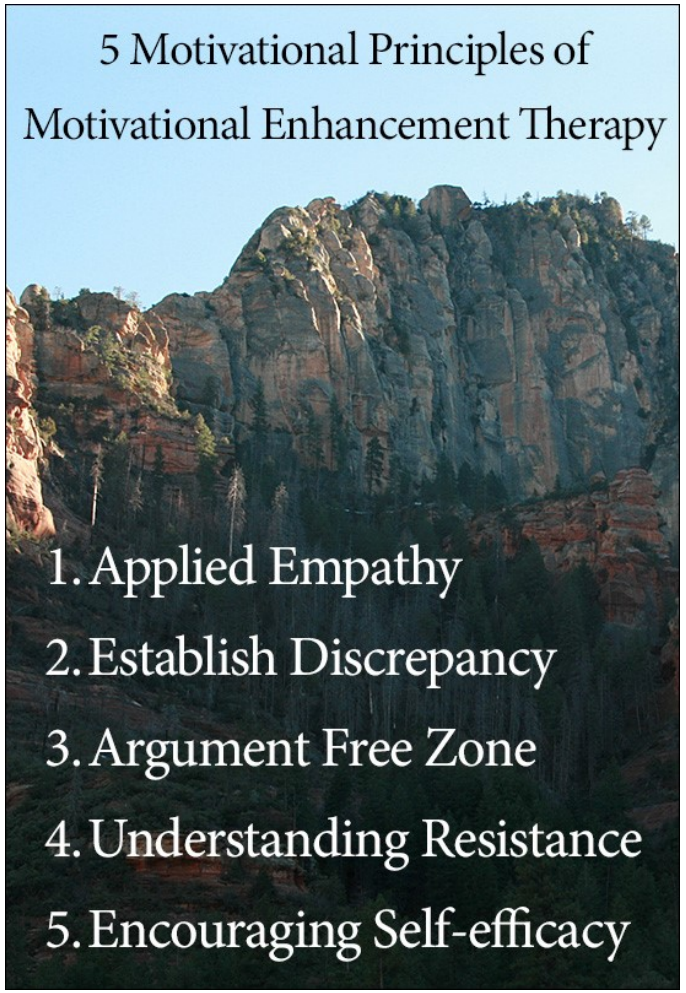
Cognitive Behavioral Therapy (CBT)

- **The positive effect of CBT plus education** on adherence with CPAP is likely due to improved self-efficacy
- CBT may take many forms
  - ***videos demonstrating CPAP use***
  - ***electronic or pamphlet information,***
  - ***relaxation techniques,***
  - ***mask fitting sessions,***
  - ***telephone or telehealth support.***



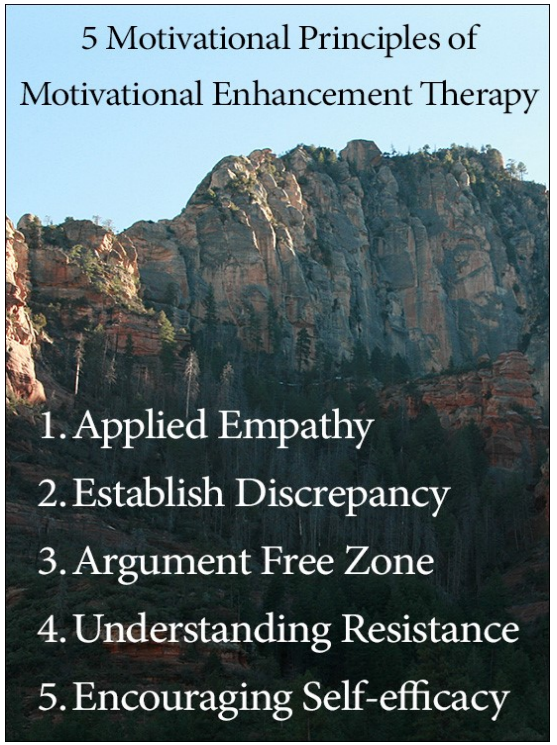
Motivational Enhancement Therapy (MET)

- MET addresses the components of CPAP adherence that can be modified such **as perception and behavior**.
- MET include interaction with the patient in person (2 -3 sessions) and by phone during the first month **to resolve perceptions, behaviors, and volitions**
- Experts **support an empathic approach** that enhances the patient's self-efficacy, is not reactive to resistance, and assists the patient in the identification of specific goals for CPAP use.



Motivational Enhancement Therapy (MET)

- **Several randomized studies have demonstrated increased CPAP use with MET**
- However the effect may be lost once it is stopped
  - Patients who received motivational interview nurse therapy (MINT) with CPAP had improved adherence at three months compared with patients who were treated with CPAP alone **(4.6 versus 3.2 hours per night)** .
  - In another randomized trial of, adherence improved by **99 minutes per night** in those who received eight months of MET with CPAP compared with CPAP alone .



Olsen S J Consult Clin Psychol 2012, Bakker JP. Chest 2016.

Side Effect Management

- Early troubleshooting of side effects, within **the first few days to two weeks of CPAP use is effective**.
- Prompt intervention should enhance **comfort and self-efficacy**
- The **assessment and troubleshooting** can be done during provider follow-up with the patient at home using **telehealth or in-person visits** with an experienced sleep technician.

Choosing The Correct Patient-Device Interface

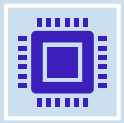
- Advocate for properly fitting interface between the patient and the device to optimize the adherence and efficacy of PAP therapy.
- Options include
  - **nasal masks,**
  - **nasal pillows,**
  - **oronasal masks,**
  - **full facemasks,**
  - **oral interfaces**
- **Nasal and oronasal masks are the commonly used interfaces.**

https://cpapmask.eu/brand/resmed/

Choosing The Correct Patient-Device Interface

Patients should be encouraged to try several different interfaces during PAP titration.

Prefer the interface that offers the best mix of comfort and efficacy is prescribed



The optimal interface varies from patient to patient and often is not the interface used during a laboratory titration.

Leading most clinicians to conclude that the best interface is **"the one the patient will use."**

Interface (mask)-Related Issues/Intolerance Of Pressure

- Some patients **cannot tolerate fixed-level CPAP** due to the feeling of pressure from the device.
- In such cases, using a **flexible pressure device** enables the patient to set the initial pressure prior to **ramping up to the prescribed pressure** before switching to an auto titratable CPAP (APAP) device or to bilevel positive airway pressure (BPAP)

Different Methods of CPAP Delivery on Adherence

- **The impact of different methods of CPAP delivery on adherence has been studied**.
- **Flexible pressure PAP devices, pressure relief PAP, Auto-titrating CPAP** are often prescribed in patients when nonadherence is due to **intolerance of positive pressure,**
- However most studies have found that routinely prescribing these measures is not associated with increased adherence rates when compared to **conventional CPAP**

Different Methods of CPAP Delivery on Adherence

- OSA patients who complain of discomfort caused by **exhaling against CPAP**
  - suggest a trial of **pressure relief** and/or the application of a **pressure ramp**
  - switch to an **auto-titrating device.**
- **Pressure Relief –**
- **Pressure relief involves lowering the delivered pressure during expiration** in order to prevent the discomfort that some patients report when breathing out against PAP.
- This feature is available on CPAP, auto-titrating CPAP (APAP), bilevel PAP in spontaneous mode (BPAP-S), and auto-titrating BPAP-S (auto-BPAP-S) devices.

Different Methods of CPAP Delivery on Adherence

- **Pressure Ramp –**
- A pressure ramp initiates PAP delivery at a low level **(usually 4 to 5 cm H_2O)** and then progressively increases the PAP to the prescribed level over a duration designated by the clinician **(usually 5 to 45 minutes).**
- There are no published data indicating that a ramp feature augments acceptance or adherence with CPAP, although many clinicians routinely prescribe a pressure ramp.
- This feature serves as a comfort measure, allowing the patient to fall asleep before reaching the higher pressures that might interfere with sleep onset.

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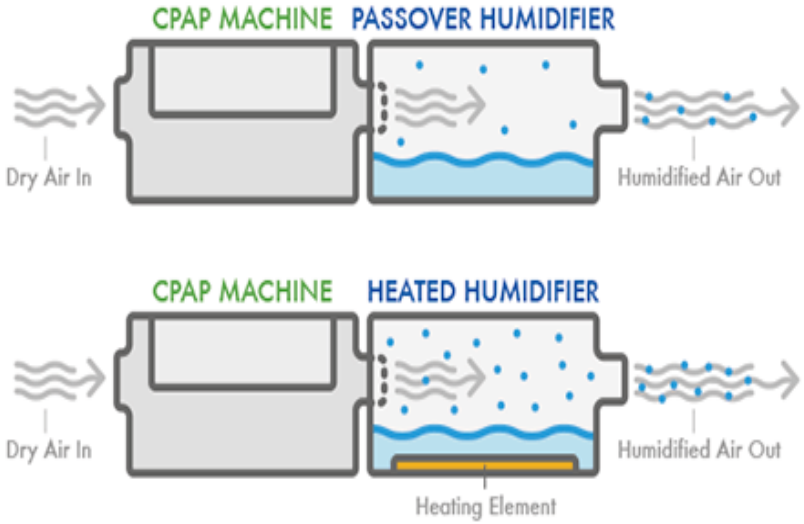
Different Methods of CPAP Delivery on Adherence

- **Auto-titratable or Other Device**
- In whom pressure relief or pressure ramping have not resolved the issue switch to an auto-titratable device (eg, APAP) on a trial basis.
  - **One meta-analysis of 64 studies** reported that pressure modification by switching to APAP resulted in approximately **13 more minutes of usage per night at six weeks.** However, the AHI scores were lower in patients on fixed-level CPAP
- Sometimes, switching to a **bilevel device** is needed, in which case we repeat an in-laboratory titration. **(BİPAP, BİPAP ST, ASV, AVAPS)**

Kennedy B, Cochrane Database Syst Rev 2019

Interface (mask)-Related Issues / Nasal or upper airway dryness

- AASM, which advocates **heated humidification** for all patients who receive PAP
- PAP airflow through the nose tends to dry and irritate the nasal mucosa and increase nasal resistance.
- **Heated humidification decreases the nasal resistance by approximately 50 percent**
- Heated humidification is particularly important in patients who have undergone **uvulopalatopharyngoplasty**



cpap.com

Richards GN, Am J Respir Crit Care Med 1996, Wiest GH Respiration 2002, Mador MJ Chest 2005, Rakotonanahary D Chest 2001, Weaver TE. 2006, Koutsourelakis I, Eur Respir J 2011

Heated Humidification

- Clinical studies have not consistently found such benefits, and heated humidification may only improve adherence in those with nasal dryness
- It is uncertain whether the **routine application of heated humidification improves adherence,** since the **evidence is conflicting.**
- However, most CPAP machines come equipped with a heated humidifier and guidelines encourage routine use of this function

Interface (mask)-Related İssues /Nasal or upper airway congestion

- Nasal congestion is a common problem that may pre-exist or be precipitated by PAP therapy.
- **Airflow resistance is higher when nasal congestion is present.**
- Administer topical agents (**nasal glucocorticoid, nasal antihistamine, topikal antimuscarinic**) or prescribe an oral antihistamine
- Switching from **a nasal to an oronasal mask** may also be helpful,

Duong M, Eur Respir J 2005, Prosise GL Chest 1994, Sanders MH Chest 1994, Mortimore IL Thorax 1998

Interface (mask)-Related Issues / Claustrophobia

- Claustrophobic patients may find **nasal pillows** less intimidating than other interfaces.
- Alternatively, we have patients undergo a trial of **mask desensitization**
- During desensitization, the patient wears the mask while awake, initially for a short period while relaxing (eg, reading or watching television).
- Once comfortable, we encourage the patient to wear the mask for progressively longer periods, with the goal of incrementally increasing the patient's tolerance of the mask and of positive pressure so that it can be worn at night during sleep.

- Edinger JD, Sleep 1993

Interface (mask)-Related İssues

- **Oral air leaks**
  - add **a chin strap** or switch to an oronasal mask
- **Others**
  - Education for issues surrounding intimacy
  - Switching to a nasal mask or pillows for **aerophagia**

Duong M, Eur Respir J 2005, Prosise GL Chest 1994, Sanders MH Chest 1994, Mortimore IL Thorax 1998. Knowles SR J Clin Sleep Med 2014

Patients Who Fail First-Line Interventions

- **Persist with education and behavioral therapy.**
- Pharmacologic therapy in the form of a **sedative-hypnotic sleep aid** is a last resort but may be attempted on a trial basis.

Patients Who Fail First-Line Interventions/ Pharmacologic Therapy

- The routine use of a sedative-hypnotic at the time of CPAP initiation is not recommended.
- **A short-term trial of sedative hypnotic therapy may be tried in those who fail all other options (eg, one to two weeks).**
- Randomized studies have yielded conflicting results

Patients Who Fail First-Line Interventions/ Pharmacologic Therapy

- **Single-Dose Therapy –**

- One trial randomly assigned 117 patients with OSA to receive premedication with **a single dose of eszopiclone (3 mg)** or placebo 30 minutes prior to attended polysomnography (PSG) for CPAP titration 4-6weeks later, the eszopiclone group used their CPAP on **more nights and for a longer duration** (four versus three hours) than the placebo group.

- **In contrast,** in a second study of 134 patients with OSA undergoing initial split-night PSG, there was no difference in the median daily CPAP use at one month among those who were randomly assigned to receive **a single dose of zaleplon or placebo**

Lettieri CJ Chest 2009, Park JG, J Clin Sleep Med 2013

Patients Who Fail First-Line Interventions/Pharmacologic Therapy

- **Two Weeks Course of Therapy –**

- Extended dosing was tested in a trial to **zolpidem, placebo, or standard of care for the first 14 days of CPAP therapy .**There was **no difference** in CPAP adherence among the three groups as measured by average nightly CPAP use or total days used.

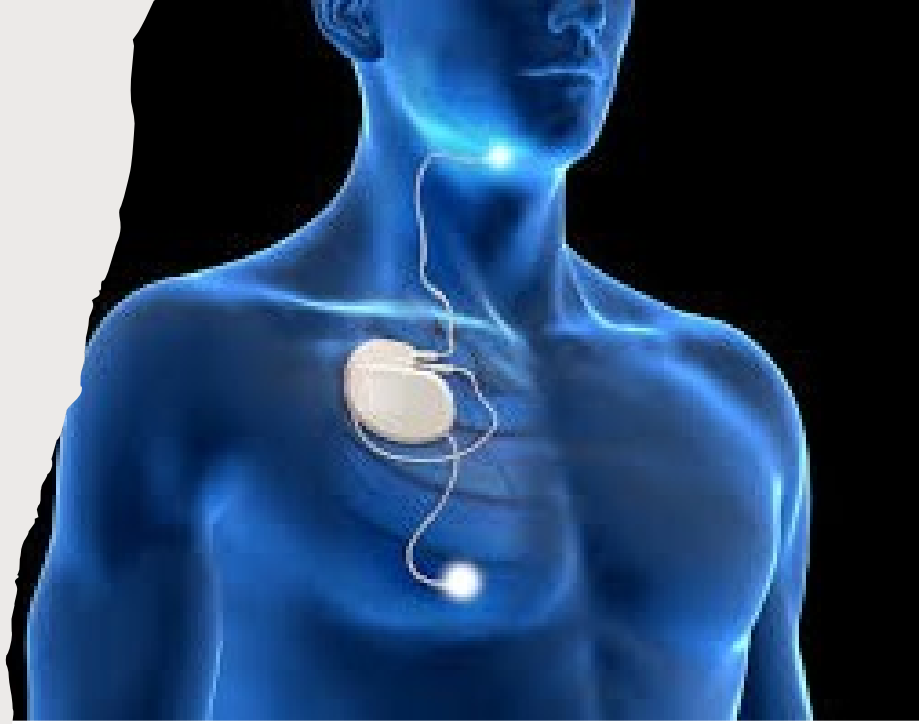
- In contrast, in a subsequent trial, 160 patients with newly diagnosed OSA were randomly assigned to receive **eszopiclone (3 mg) or placebo** during the initial 14 nights of CPAP therapy. After six months of follow-up, patients who received eszopiclone used their CPAP device for more nights and for a longer duration

- One **meta-analysis included over 1000 patients** with OSA reported that patients who were treated with nonbenzodiazepine sedative hypnotics had **higher rates of adherence** than those who did not receive such medication

Bradshaw DA Chest 2006., Lettieri CJ Ann Intern Med 2009,, Wang D Sleep 2021

Patients Who Fail First-Line Interventions/ Other Options

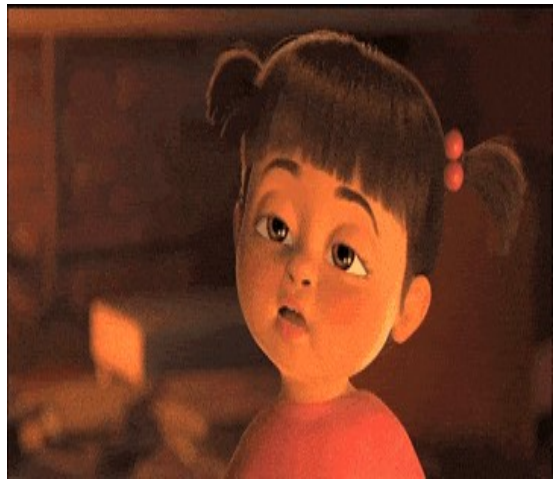
- If the side effects persist despite adequate intervention, **we typically repeat a titration** study
- Alternatively, other treatments for OSA such as **oral appliance, surgery, or hypoglossal nerve stimulation** should be considered.



Wang D Sleep 2021

Patients Who Are Adherent With Residual Sleepiness

- For patients who are adherent and in whom CPAP is adequate but **who remain sleepy**
  - evaluate for other etiologies of excessive sleepiness
  - Evaluate suitability for a wakefulness-promoting agent.



Modafinil

Start with 100 or 200 mg every morning for the first week →.
titrate up to 300 -400 mg over the next two to three weeks, as needed.

Armodafinil

Start with 150 mg once daily →
titrate up to 250 mg once daily as needed.

Useful Resources For Education

- Educational materials such as **pamphlets and videotapes** for both clinicians and patients are available from several sites including
  - **The American Academy of Sleep Medicine**,
  - **The Sleep Foundation**
  - **The American Sleep Apnea Association**

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Thank you

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