

The Care and Cleaning of your PAP Device

Positive airway pressure therapy (PAP) is used during sleep to treat obstructive sleep apnea (OSA). These devices work by blowing pressurized air through a mask or nasal pillows into the air passages. This helps to keep the air passages from collapsing, allowing for better breathing during sleep. Many people have a humidifier attached to the device to help keep the air moist and avoid drying out the nose passages. Since air is being blown directly into your air passages, it is important to keep the PAP device and its supplies clean.



The purpose of this fact sheet is to offer tips on the care and cleaning of your PAP device and supplies. (For more information on OSA and PAP therapy, go to the ATS patient information series at www.thoracic.org/patients.)

What parts do I need to clean?

You will need to clean the PAP device, humidifier chamber, tubing, and mask or nasal pillows. Air filters for the PAP device may need to be replaced and/or cleaned on a regular basis as well.

When and how do I clean my PAP device and supplies?

The PAP device and supplies should be cleaned with warm soapy water using mild dish detergent or baby shampoo or a mixture of equal parts white vinegar and water. After washing, rinse thoroughly with fresh warm water and allow to air dry away from direct sunlight or heat. Additional care instructions are listed in the Table below.

PAP device—After unplugging the power cord, wipe the outside of the device with a soft cloth on a weekly basis to remove any dirt or dust. Some manufacturers recommend a damp cloth while others recommend a dry cloth. Do not place the device in water.

Humidifier chamber—Every day, empty the distilled water from the humidifier chamber. Have a routine. Empty it when you wake up from sleep and refill

the chamber with fresh distilled water before you go to sleep again. Always use distilled water in the chamber to avoid any mineral deposits or build-up in the chamber or PAP device. Once a week, wash the humidifier chamber. Do not place the chamber in direct sunlight or expose it to a lot of heat to dry it, as the chamber could warp or crack. Some chambers are top rack dishwasher safe, but you must check the manufacturer's cleaning instructions carefully first.

Tubing—Once a week you should wash and rinse the tubing. After cleaning, hang the tubing over a towel rack or shower curtain rod to thoroughly air dry.

Mask—Every day, wipe the cushion or nasal pillows with a damp cloth and a mild detergent to remove any body oil, sweat, or debris that may have built up while you were wearing it. There are mask cleaning wipes you can buy that are designed for use with PAP masks and nasal pillows and are safe to use. Baby wipes or household cleaning wipes are not recommended to use on your cushion or pillows. Once a week, you should take the whole mask or nasal pillows apart and wash, rinse, and air dry the mask before putting it back together.

Headgear—Once a week, remove the headgear from the PAP mask or nasal pillows and hand wash it. Do not wash your headgear in a washing machine. You should then rinse and air dry the headgear before putting it back on the mask.

Part	Frequency of Care and Cleaning			How to Clean	Rinse	Air Dry
	Daily	Weekly	Monthly			
Humidifier Chamber	Empty and refill chamber with distilled water	Clean		Warm soapy water or equal parts vinegar and water	Fresh warm water	Yes- out of direct sunlight and/or heat
Cushion/Pillows	Clean with damp cloth and mild detergent; may use mask wipes	Clean		Warm soapy water or equal parts vinegar and water	Fresh warm water	Yes- out of direct sunlight and/or heat
Mask		Clean		Warm soapy water or equal parts vinegar and water	Fresh warm water	Yes- out of direct sunlight and/or heat
Headgear		Clean		Warm soapy water	Fresh warm water	Yes- out of direct sunlight and/or heat
Tubing		Clean		Warm soapy water or equal parts vinegar and water	Fresh warm water	Yes- hang over towel rack or shower curtain rod
Sponge Filter		Clean		Warm soapy water	Fresh warm water; squeeze out excess water	Yes
Disposable (paper) Filter			Replace	Not needed	Not needed	Not needed
PAP Device		Clean		Wipe outside with soft (or damp) cloth	No	Yes (if needed)

Filters—Some older PAP devices have a reusable pollen filter that looks like a small foam sponge. This should be washed once a week. After rinsing, excess water should be squeezed out of the filter, it should be allowed to air dry. The ultrafine white paper filter should not be washed. This filter is disposable and should be replaced monthly or more often if it looks dusty or dirty.

How do the commercially available PAP sanitizing devices work?

There are PAP sanitizing devices you can buy to help clean your equipment. These work by using ozone or ultraviolet (UV) light to clean the PAP supplies. Although these devices are convenient, they are not necessarily medically superior to the cleaning methods described above. It is very important to carefully follow the manufacturer’s instructions for proper use.

What happens if I don’t clean my PAP device?

If you do not clean your PAP device and supplies, bacteria and mold may begin to grow. This may put you at higher risk for getting sick. Your device and supplies may be more likely to break down earlier if not kept clean. You may notice the device or mask starting to smell bad as well.

Author: Helena Schotland, MD

Reviewers: Marianna Sockrider MD, DrPH, Iris Perez, MD

Rx Action Steps

- ✓ Check the manufacturer’s instructions for cleaning recommendations.
- ✓ Do not use bleach, rubbing alcohol, or harsh chemicals to clean your PAP device or supplies.
- ✓ Always use distilled water in your PAP humidifier chamber.
- ✓ Consider having a back-up mask and tubing set so you can rotate while one is drying.

Healthcare Provider’s Contact Number:

Resources

American Thoracic Society
 • www.thoracic.org/patients

American Academy of Sleep Medicine
 • <http://sleepeducation.org/>

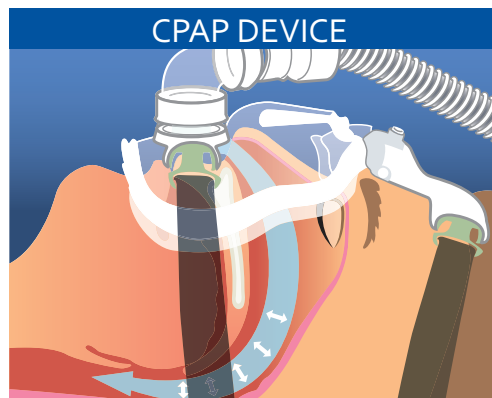
National Sleep Foundation
 • <https://www.sleepfoundation.org/sleep-disorders>

This information is a public service of the American Thoracic Society. The content is for educational purposes only. It should not be used as a substitute for the medical advice of one’s healthcare provider.



PAP Therapy—Quick Tips for Troubleshooting to Address Problems with Use

Positive airway pressure therapy (PAP) is used to treat obstructive sleep apnea (OSA). A machine is used with a mask to blow air into the air passages. This helps keep the person's air passages from collapsing, allowing him or her to breathe better during sleep. This pressurized air is delivered through a tube to a mask that fits over the person's nose or nose and mouth or nasal pillows (prongs) that fit into a person's nostrils.



PAP therapy is a very effective way to treat OSA, but people sometimes can have problems with the machine and/or mask/nasal pillows. It is important to promptly address any problems that prevent you from using PAP therapy. The purpose of this fact sheet is to offer quick tips to troubleshoot some common problems related to PAP therapy. For more information on OSA and PAP therapy go to the ATS patient information series at www.thoracic.org/patients. For specific tips and action steps, see page 2.

With time, patience, and practice, using your PAP machine will become easier. Do not hesitate to contact your healthcare provider if there are troublesome issues that prevent you from using your PAP machine successfully.

Author: Helena Schotland, MD

Reviewers: Marianna Sockrider MD, DrPH, Iris Perez, MD and Vidya Krishnan, MD, MHS

Resources:

Sleep Education—American Academy of Sleep Medicine

- <http://sleepeducation.org/essentials-in-sleep/cpap>

National Sleep Foundation

- <https://sleepfoundation.org/ask-the-expert/cpap-101-expert-tips-getting-started-continuous-positive-airway-pressure-cpap>

National Heart, Lung, and Blood Institute

- <https://www.nhlbi.nih.gov/health/health-topics/topics/cpap>

U.S. National Library of Medicine

- <https://medlineplus.gov/ency/article/001916.htm>

American Thoracic Society

- <https://www.thoracic.org/patients/patient-resources/resources/cpap-for-osa.pdf>

This information is a public service of the American Thoracic Society. The content is for educational purposes only. It should not be used as a substitute for the medical advice of one's healthcare provider.

Rx *Tips & Action Steps*

Problem	Solutions
I don't know how to put on my mask	<ol style="list-style-type: none"> 1. Turn your PAP machine on, before placing the mask on your face 2. When the mask makes a good seal with your face, you will no longer hear air blowing out of the mask 3. Adjust the straps (make sure they are not too loose and not too tight)
My mask leaks at night	<ol style="list-style-type: none"> 1. Readjust your mask (as above) 2. If possible, lay the PAP tubing on your chest and cover it with a blanket (so the tubing does not pull on the mask and cause leaks) 3. Use a commercially available CPAP tubing holder 4. Use a specialized sleeping pillow (with cut-outs or indentations) designed for PAP users 5. Consider being fitted for an alternative mask or nasal pillows 6. Raising the head of your bed may help prevent leak
Water collects in my PAP tubing	<ol style="list-style-type: none"> 1. Decrease the heat setting on the attached heated humidifier 2. Increase the temperature of your bedroom 3. Insulate the tubing by using a fleece cover or laying the tubing on top of your chest and covering it with a blanket 4. Use heated PAP tubing (if your PAP machine has this option)
I have stomach pain or excessive gas	<ol style="list-style-type: none"> 1. Change your sleeping position and/or the number of pillows that you sleep on 2. Use the patient controlled setting on your PAP to reduce air pressure slightly when you breathe out (if your PAP machine has this option) 3. Talk to your healthcare provider to see if switching to an auto-PAP or bi-level PAP machine is right for you or switching to nasal pillows or mask from face mask
I have difficulty falling asleep with my PAP	<ol style="list-style-type: none"> 1. Keep trying – the more you use your PAP machine, the easier it becomes 2. Practice good sleep habits 3. Try wearing your PAP during the day while reading or watching television to get used to it 4. Talk to your sleep doctor if your PAP setting can be changed (discuss ramp or autoramp)
My PAP pressure feels too high	<ol style="list-style-type: none"> 1. You may get used to the pressure over time 2. Use the "ramp" function on the PAP machine to start the PAP machine at a lower pressure. The pressure will increase over time while you fall asleep 3. Use the patient controlled setting on your PAP to reduce air pressure slightly when you breathe out 4. Talk to your healthcare provider to see if an auto-PAP or bi-level PAP machine is right for you
I have nose and/or mouth dryness	<ol style="list-style-type: none"> 1. Increase the heat setting on your humidifier 2. Add a chin strap if you are using a nasal mask or nasal pillows 3. Consider changing to a full face mask 4. Use saline spray or gel for your nasal passages 5. Artificial saliva gel, spray, or mouthwash can be helpful for mouth dryness 6. Use heated PAP tubing (if your PAP machine has this option)
My nose is stuffy or runny	<ol style="list-style-type: none"> 1. Increase the heat setting on your humidifier 2. Use heated PAP tubing (if your PAP machine has this option) 3. Talk to your healthcare provider about whether a prescription nasal spray is right for you

Other Therapies for Sleep Apnea

Treatment is needed for obstructive sleep apnea (OSA) because untreated OSA can result in serious health problems. Continuous positive airway pressure (CPAP) therapy is the most common treatment used for obstructive sleep apnea (OSA). For those who cannot use CPAP or want to try another option, there are other therapies that can work for people with OSA.



For many people with moderate to severe OSA, CPAP is the main treatment. CPAP improves the symptoms of OSA like sleepiness, poor concentration, lack of energy and may improve blood pressure and other heart related problems. However, some people find it difficult to use CPAP, so other therapies may be prescribed. These same therapies are often the treatment of choice for those with mild OSA.

What are non-CPAP therapies for sleep apnea?

While CPAP therapy is often the preferred treatment, some patients will not or are not able to use this device. Other treatments that may help improve breathing during sleep and reduce the risk of complications from OSA include: oral appliances, weight loss, positional therapy, surgery, implantable nerve stimulator, nasal expiratory resistance, oral negative pressure devices, and mouth and throat exercises. There are currently no medications that are recommended or approved for the treatment of OSA.

What are oral appliances?

There are a number of different oral appliances used for OSA. These include tongue retaining devices and mandibular advance devices. The purpose of an oral appliance is to keep your airway open while you sleep, by positioning your lower jaw forward. This prevents blockage of your airway when your tongue relaxes during sleep. You may need a sleep study with the device in place to check that your OSA is completely controlled. Some of the devices appear to be as good as CPAP in improving breathing during sleep and preventing daytime symptoms in people with OSA. The devices do not work in everyone. There may be one device that works better for you than others.

How does weight loss work to help OSA?

Your healthcare provider can discuss if weight loss might help improve your sleep apnea. Obesity is one of the major risks

for OSA. Losing weight, especially reducing fat deposits in the neck and tongue, can improve sleep apnea. Even though weight loss may not get rid of sleep apnea completely, there are many other health benefits from having a normal weight. Safe weight loss also takes time, so you may decide to use weight loss along with other therapies that act more quickly. You may need a follow up sleep study to show that your weight loss has improved your OSA.

How does positional therapy work?

How your sleeping position affects your breathing can be evaluated with a sleep study. Some people only have OSA when they sleep on their back. For others, OSA may be much worse when they sleep on their back. In these cases, trying to get a person to only sleep on his or her side can be a useful treatment. This can be done in several ways.

- Pillows supporting the back usually do not provide enough support or are easily tossed on the floor during sleep.
- Devices that provide an alert, such as a vibration, so that the user shifts position.
- Devices, such as specialized belts or shirts that make it uncomfortable to sleep on one's back, so the user will tend to sleep in another position.

For some people, the OSA and snoring go away completely when they sleep on their sides, but as with all treatments, not everyone gets the same benefit from positional therapy. Some people are not able to stay in these positions each night for long periods because of other conditions which make it uncomfortable such as arthritis or hip pain. You can talk with your healthcare provider about how well positional therapy works for you. You might need a sleep study to check that positional therapy is working well.

What kind of surgery can I have for OSA?

Surgery is not frequently used to treat OSA in adults because it doesn't work very well for most adults. However, in some cases upper airway or throat surgery may be helpful to improve airflow into your windpipe. For example, if you have large tonsils or adenoids, it may help to take them out as they can block air flow in the nose and throat. This is more commonly done in children with OSA than adults. If you have any nasal blockage, an operation may help clear the blockage in your nasal passages. Other surgical approaches may be helpful in rare cases. Your healthcare provider can discuss if surgery may help you. You might need a sleep study 8-12 weeks after surgery to check to see that your OSA is improved.

What is hypoglossal nerve stimulation?

A more recent surgical procedure implants a small battery pack into the upper chest that connects to a wire that attaches to the nerve controlling the tongue muscles (such as brand Inspire). During sleep, gentle electrical pulses stimulate the tongue muscles to contract and pull forward, keeping the airway open. This may be used by itself or in combination with other therapies.

What are other therapy options?

Other options have been developed for patients with OSA.

- Nasal expiratory resistive devices (such as brand Provent®) are disposable adhesive devices placed over the nostrils. This device limits a full exhale during sleep. This results in air staying in your airway and keeping your airway open. Studies show mixed results, with the best results usually seen in people with milder (less severe) disease. These devices typically will not fully cure your OSA.
- Another option is a device placed in your mouth, connected to a machine called an oral negative pressure device (such as brand Winx®). This device works by causing negative pressure in the mouth area. This keeps your tongue and soft palate at the front of your mouth so they don't relax and block your airway. Studies over a short time have shown this device to be helpful for some people. It typically will not fully cure your OSA and may be uncomfortable to use.
- Muscle training exercises (oropharyngeal exercises and myofunctional therapy) may also be used in combination with other therapies to improve your OSA. Working to strengthen the muscles of your tongue, face and throat may reduce airway narrowing or closing during sleep. They typically will not be fully successful on their own.
- Regular exercise and avoiding alcohol, tobacco, and opioid medications ("painkillers") is also recommended.

How can I get these therapies?

Your healthcare provider can refer you to a sleep specialist. The sleep specialist will evaluate if any of these approaches will be useful in treating your sleep problem. They will usually

begin by finding out how bad your sleep apnea is by doing an overnight sleep study. After the sleep study, you will have a follow up appointment with your sleep specialist to talk about the results of the sleep study and to discuss possible treatment options.

How do I know if my therapy is working?

When a therapy is working well, you should have little or no snoring. You may notice you sleep more restfully. You may see improvement in daytime sleepiness and fatigue. A good way to find out if you are getting full control of your OSA is to have a repeat overnight sleep study with the device in place, after weight loss or the surgical procedure. If symptoms of snoring or sleep apnea return (for example, your tiredness returns during the day), it is important to have a follow up appointment with your healthcare provider or sleep specialist. Sometimes a therapy may seem to work at first but does not continue working over time. You should always pay attention to your sleep quality and watch for symptoms.

Author: James Metz, DDS, ABDSM, Mickey Harrison, DDS

Reviewer: Suzanne C. Lareau RN, MS, Marianna Sockrider MD, DrPH, Helena M. Schotland, MD

Rx Action Steps

Other therapies besides CPAP are available for sleep apnea and may be helpful in treating OSA in some people.

- ✓ Speak with a sleep specialist or your healthcare provider to find out if any of these therapies may help you
- ✓ If you are obese or overweight, consider a safe weight loss program even if you are using other therapies.
- ✓ If you still have symptoms despite using the therapy, see your sleep specialist.
- ✓ Keep follow-up appointments and discuss if and when you need a repeat sleep study.

Healthcare Provider's Contact Number:

Resources

WebMD

- <http://www.webmd.com/sleep-disorders/sleep-apnea/tc/sleep-apnea-oral-devices-topic-overview>

American Thoracic Society

www.thoracic.org/patients/

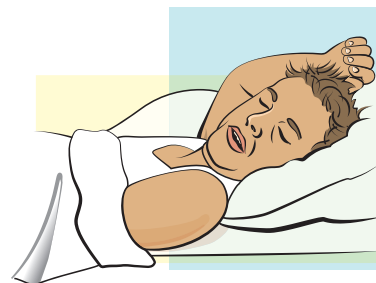
- CPAP
- Oral Appliances
- Sleep Studies

This information is a public service of the American Thoracic Society. The content is for educational purposes only. It should not be used as a substitute for the medical advice of one's healthcare provider.



Oral Appliances for Sleep Apnea in Adults

Oral appliances are devices that can be used to treat some people who have mild or moderate Obstructive Sleep Apnea (OSA) and snoring. There are different types of oral appliances. Common ones include: Mandibular Advancement Devices (MAD), Mandibular Advancement Splints (MAS), Mandibular Repositioning Appliances (MRA), or Tongue Retaining Devices (TRD).



Oral appliances hold your tongue in place so that your airway stays open while you sleep. Oral appliances are placed into your mouth at night before you go to bed, and worn for the entire time you are sleeping, and taken out when you are awake.

How do oral appliances work?

Oral appliances work by pushing or pulling your lower jaw forward. By doing this, your tongue is kept in a position that does not block your airway. This reduces the risk of snoring or that your tongue may obstruct your airway during sleep. If this device is helping you, the sound of snoring should be gone entirely or lessened.

How effective are oral appliances?

As with all treatments, not everyone gets the same benefit from oral appliances. For some, the OSA and snoring go away completely, while for other people, other forms of treatment are needed. Oral appliances are more likely to work if you have mild or moderate sleep apnea; more recent evidence supports use for some people with severe sleep apnea as well. If your sleep apnea gets better when you lie on your side (compared to sleeping on your back) and if you are not overweight, you are also more likely to benefit from this appliance. If you have central sleep apnea (a less common condition than OSA), then oral appliances are unlikely to be helpful. Until you have been properly fitted for an oral appliance and tried it, no one can know how well it will work for you.

How well do oral appliances work compared to CPAP?

CPAP (Continuous Positive Airway Pressure) is a reliable treatment for sleep apnea. Immediate results are

typically seen with CPAP regardless of how bad the sleep apnea is. An oral appliance will usually improve your sleep apnea, but may not completely control it. If you have moderate or severe OSA, CPAP is more likely to work to correct your sleep apnea than an oral appliance. However, an oral appliance may be a better option than no treatment at all if you cannot tolerate CPAP. Oral appliances are also not the main therapy if you have significant heart disease or are very sleepy during the day. In these cases, CPAP is the best treatment. A sleep specialist can provide guidance regarding the most appropriate therapy for you. For more information see the ATS Patient information series piece on "Continuous Positive Airway Pressure for Adults with Obstructive Sleep Apnea" at www.thoracic.org/patients.

Are there any side effects from using oral appliances?

If fitted well, the oral appliance should be comfortable during the night. However, because it acts to push your jaw forward, some people feel discomfort when first using the appliance. This discomfort tends to improve as you use it more. If discomfort happens, it is usually in the joint at the back of your jaw, just in front of the ear (the temporomandibular joint). This discomfort should go away when you take the appliance out in the morning. Also, oral appliances may cause increased saliva in your mouth, or make your teeth feel tender. These symptoms usually settle down quickly the more you use the device. Over time, there may be tooth movement, changes in your bite, or problems with the joint and muscles of your jaw. It is important to have regular follow-up visits with the dentist who supplied you with the appliance to detect and manage problems early.

How can I get an oral appliance?

Your healthcare provider can refer you to a sleep specialist in order to find out how bad your sleep apnea is. This evaluation usually requires an overnight sleep study and a separate follow-up appointment with your sleep specialist to talk about the results and discuss possible treatment options. If you decide to try an oral appliance, your sleep specialist will refer you to a dentist who has extensive training in the treatment of OSA. For more information about sleep studies see ATS Patient Information Series "Sleep Studies in the Sleep Laboratory and at Home" at www.thoracic.org/patients.

Does the appliance need to be specially fitted for me?

Each person has a different mouth and jaw shape, so you should have the oral appliance made to fit you. Your dentist will take an impression of your teeth and send the dental impression (dental mold) to the lab for the appliance to be made. After a few weeks, you will go back to the dentist's office, where the appliance is fitted into your mouth. It will be adjusted so that it moves your jaw forward to a position that will be effective but is still comfortable. Your dentist will help supervise the adjustment of the device over several weeks. After the appliance is fitted, follow-up visits with your dentist or sleep specialist will be needed.

There are some kinds of dental devices that you can buy over-the-counter (without a prescription). These devices are cheaper, but they usually do not work. They may take up lots of space in your mouth, pushing your tongue toward the throat and making your OSA worse. Getting the proper fitting device is important in helping your sleep problem.

How should I care for my oral appliance?

You should brush and floss your teeth before you put your appliance in each night. Your dentist can prescribe fluoride gel to help prevent tooth decay while using your appliance. Plaque can also build up on an appliance. You must therefore clean it daily. Make sure you dry it out each day before using it again. Also, keep your appliance safely away from children and pets.

How do I know if oral appliance is working?

When an oral appliance is working well, there should be no snoring. If you are wearing the appliance because of sleep apnea, you may see improved sleepiness, fatigue and other symptoms of sleep apnea. A good way to find out if you are getting the help you need from your oral appliance is to have a repeat overnight sleep study with the oral appliance in place. If the study shows that wearing the oral appliance has helped your OSA, you

should continue to use it every night. If it is not helping your sleep apnea, other treatments (such as CPAP) will be recommended.

What do I do if my oral appliance does not seem to be working well?

If symptoms of snoring or sleep apnea return (for example, feeling tired during the day), it is important to have a follow up appointment with your dentist or your sleep specialist. Your dentist might need to adjust the appliance. After a number of years, some people using an oral appliance find they need to consider other treatments for their OSA, especially if they have had weight gain.

Author: Sutapa Mukherjee MBBS, FRACP, PhD

Reviewers: Suzanne C. Lareau RN, MS; James Metz, DDS, DABDSM; Mickey Harrison, DDS; Marianna Sockrider, MD, DrPH

Rx Action Steps

Oral appliances may be more convenient than other forms of therapy, but make certain if you use one, it is fitted properly and corrects your sleeping issues.

- ✓ Speak with a sleep specialist to find out if an oral appliance may help you
- ✓ If your appliance is not making your symptoms better, report back to your specialist
- ✓ Keep follow-up appointments with your sleep specialist &/or dentist
- ✓ Clean your appliance daily

Healthcare Provider's Contact Number:

Additional Resources:

American Academy of Sleep Medicine:

<http://www.sleepeducation.com/disease-management/oral-appliance-therapy/overview>

American Sleep Apnea Association:

<http://www.sleepapnea.org/diagnosis-and-treatment/treatment-options.html>

Sleep Health Foundation (Australia):

<http://www.sleephealthfoundation.org.au/information-library/information-by-topic.html>

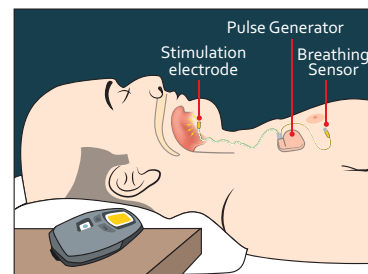
This information is a public service of the American Thoracic Society. The content is for educational purposes only. It should not be used as a substitute for the medical advice of one's health care provider.



Upper Airway Stimulation/Hypoglossal Nerve Stimulator

An alternative treatment for Obstructive Sleep Apnea

Obstructive sleep apnea (OSA) is a common sleep disorder and if not treated, can lead to many health problems. Continuous positive airway pressure (CPAP) is the standard first line treatment for OSA, but some people may not be able to use CPAP or get good benefit from it. If you are unable to use CPAP, there are other forms of treatment you may want to try. These include various oral appliance devices, upper airway surgery, or upper airway stimulation (UAS). This fact sheet describes the UAS device and how it works. For more information on OSA, CPAP, and other treatment options, see the ATS Patient Information Series at www.thoracic.org/patients.



What is upper airway stimulation (UAS)?

With OSA, the muscles and soft tissue in the throat area and the tongue relax during sleep, causing collapse of the upper airway and blockage of airflow. The Inspire® Upper Airway Stimulation (UAS) device (also called Hypoglossal nerve stimulation or HNS device) is a surgical option for OSA. The UAS device is implanted in the chest and works to stimulate the tongue to keep the upper airway open during sleep. An upper airway stimulation device sends an electrical signal to the hypoglossal nerve, which is a nerve that goes to the tongue. When the nerve is stimulated, it gently nudges the tongue to move forward and prevents the tongue from blocking the air passage.

What are the advantages of UAS therapy?

Some advantages of UAS are:

- it may be an easier treatment to tolerate for people who can't stand wearing a CPAP mask
- there is no extra equipment to clean and maintain
- there are no ongoing supply costs
- when you travel you only need to carry a small remote

Who is a candidate for Upper Airway Stimulation?

1. Adults who are older than 18 years of age and have a body mass index (BMI) less than 32kg/m² (see the resource listing on how to calculate your BMI).
2. People with moderate or severe OSA. This is based on the results of a sleep study (polysomnogram) showing an apnea-hypopnea index (AHI) of 15-65 events per hour.
3. People who are unable to tolerate positive airway pressure (PAP) therapy for OSA.

You are not a candidate to try the UAS device if you are very obese or have central sleep apnea. If you do meet the above criteria and are interested in this therapy, you should discuss this with your healthcare provider. Your healthcare provider can refer you to a sleep specialist or an Ear, Nose and Throat (ENT) surgeon who can advise you if this is the best therapy for you.

You will need to have a test called a drug-induced sleep endoscopy (DISE) to see if you are eligible for a UAS device. You will be given a medication to make you sleepy. While you are asleep, the surgeon or sleep provider will look into your upper airway with a small camera. The specialist will look at your tongue and throat structures during sleep to see if you may benefit from placement of the UAS device.

How does the device work?

There are four components to the UAS device (see figure):

1. A generator that is surgically implanted in the chest just below the collar bone
2. A breathing sensor electrode that is surgically implanted on the side of the chest by the ribs
3. A stimulation electrode that is surgically implanted around the hypoglossal nerve of the tongue
4. A small remote control used to control (turn on and off) the device

Each time you make an effort to breathe, the breathing sensor detects your breathing effort and sends a signal to the generator. The generator then signals the stimulation electrode to act on the nerve that causes your tongue muscles to contract. With every stimulation, your tongue is gently moved forward to keep your airway open. You can adjust the setting for level of stimulation based on how it is working.

The device is controlled using a small remote control. You turn on the device during bedtime and turn it off when you wake up. You can also pause the device when you wake up in the middle of your sleep.

What to expect during UAS surgery

Surgery to place a UAS device is typically an outpatient procedure that is done under general anesthesia. Three small incisions are made on the skin. The small battery-operated generator is implanted on the chest under the skin and soft tissue below the collar bone. The breathing sensor electrode is placed under the rib cage. The stimulation electrode is wrapped around the hypoglossal nerve that is located under the jaw. The surgery is

generally well tolerated with minimal risk of complications. You go home the same day after you recover from the anesthesia.

What are possible complications of the surgery?

Like any surgery, you can get infection and bleeding at the surgical site. You should expect some pain after the surgery, but this is generally mild, and well tolerated when treated with oral pain medications. The pain should get better within a couple of weeks. Nerve injury is a rare complication which occurs in less than 1 in 100 people. This is usually temporary but can lead to abnormal tongue movement. It almost always gets better on its own in about 6-8 weeks.

When can I start using the UAS device after surgery?

UAS is not used right after surgery. The surgical scars are allowed to heal for about a month or two prior to turning on the device for the first time. A longer healing time may be needed for some people. Your healthcare provider will determine the best timing for your device to be turned on. When your provider turns on the device for the first time (usually during an outpatient clinic appointment), you should not expect any pain. Your healthcare provider will guide you through the process and will adjust the settings on your device depending on your tongue movement and comfort. You will learn how to operate your remote control so you can adjust the settings of your device. You will be given a range of settings that you can adjust at home. The settings will range from a low number to a high number. The higher the number, the stronger the signal to the nerve.

What should I expect after my device is turned on?

Once your healthcare provider turns on your device, you should be able to start using the device at home. For the next 3 months, the goal is for you to get used to the device. You should use the device every night for the entire time that you are asleep. Using your remote control, you will need to slowly increase your setting (which is the strength of the signal from the generator to the nerve) based on your healthcare provider's instruction. If you are having issues tolerating it, contact your healthcare provider.

Once you are used to the device, you will need to have a sleep study to check how well the UAS is working to treat your OSA. During the study, the setting on the device can be adjusted to find the best settings that will treat your sleep apnea. You will be told if any change in your settings is needed based on the results of your sleep study.

You will need to follow closely with your healthcare provider to ensure that the therapy is working well for you. At each clinic visit, your healthcare provider will check the settings and battery level of your device and how many hours you are using the device. Adjustments can be made to your settings based on your comfort and symptoms.

How do I care for my implant?

Once the surgical wounds have healed, there are no particular precautions necessary. You should always have reserve batteries for the remote. The battery in the generator will last for about 10 years. At that point, it will need to be replaced during an outpatient surgery. You should contact your healthcare provider if you have any issues or concerns.

Can I go through security at airports?

You should have no problem at the airport while going through the security scanner. You should let the TSA (Transportation Security Administration) officer that you have stimulator (pacemaker type device) implanted to avoid any inconvenience.

You will receive a device identification card to carry with you stating that you have a surgically implanted device.

Can I get x-rays, CT scans or MRI scans with UAS?

For medical purposes, you should have no issues getting CT scans or X-rays of any parts of your body. Whether you can get MRI scans depends upon the model of the device and the technique of the MRI. You should always notify any healthcare provider about your device when planning such testing. You should always carry the device identification card as that will make it easier to explain what you have to medical staff and providers. More details about MRI scans are available on <https://www.inspiresleep.com/for-healthcare-professionals/mri-information/>

Reference: Upper Airway Stimulation for Obstructive Sleep Apnea. Strollo et al. NEJM 2014; 370:139-49

Authors: Shalini Manchanda, MD, FAASM, FCCP, Pritam Neupane, MD, FACP, FCCP, Ninotchka L. Sigua, MD
Reviewers: Iris Perez, MD, Helena Schotland, MD, Marianna Sockrider MD, DrPH

Rx Action Steps

- ✓ Speak with your healthcare provider if you are having issues with PAP therapy or think that you are not getting the benefit as expected with PAP therapy.
- ✓ Ask about other therapies for sleep apnea that you may be able to try.
- ✓ Ask about upper airway stimulation device and discuss whether this is an option for you.
- ✓ Always practice good sleep habits and exercise regularly.

Healthcare Provider's Contact Number:

Resources

American Thoracic Society

- www.thoracic.org/patients/
 - Obstructive Sleep apnea
 - CPAP therapy for OSA
 - Sleep Studies
 - Alternative Therapies for OSA
 - Healthy Sleep in Adults

BMI calculator

- https://www.nhlbi.nih.gov/health/educational/lose_wt/BMI/bmicalc.htm

American Sleep Apnea Association

- <https://www.sleepapnea.org/treat/sleep-apnea-treatment-options/>

Inspire Medical Systems

- <http://manuals.inspiresleep.com/>
- <https://www.inspiresleep.com/for-healthcare-professionals/our-technology/>

This information is a public service of the American Thoracic Society. The content is for educational purposes only. It should not be used as a substitute for the medical advice of one's healthcare provider.

