Obstructive Sleep Apnea

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“Apnea” comes from the Greek word, “apnous” meaning breathless. "Sleep apnea" is a medical condition where you stop breating in your sleep. When you are awake, the muscles of your upper airway hold it open. When you are asleep, these muscles relax and the only thing holding your airway open is the elasticity of these tissues along with the size and shape of your airway. In people with *Obstructive Sleep Apnea* (OSA), the soft tissues of the tongue and soft palate fall back and start to block off the airway as they fall asleep. In addition, the side walls of the pharynx (back of throat) also collapse inward. Essentially, when you suck in your breath, you suck the airway closed, not only front to back, but side to side as well. For a good analogy, it is like drinking a thick milkshake through a thin walled straw. If you suck too hard, the straw collapses and you cannot get any milkshake through. If you suck less hard, the straw only partially collapses and you can get some milkshake through.

When there is only very mild narrowing, adequate airflow remains but there is more turbulence as the air flows through the restriction. This turbulence vibrates the soft tissues at the back of the throat causing the snoring noise. This is like putting a spray nozzle on a hose. The same amount of water goes through but the water makes more noise flowing through the restriction of the nozzle. When the restriction in the airway gets worse, it creates a partial obstruction and there is reduced airflow. This is called a ‘hypopnea’ or “partial apnea”. As the restriction in airflow becomes complete, there is no airflow at all. The complete obstruction is called an “apnea”. (See Figure 1)

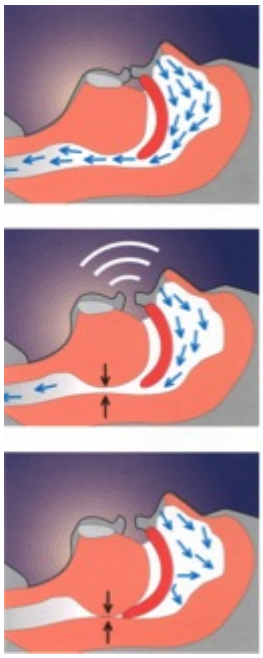


Figure 1

Whether obstruction is a hypopnea or an apnea, the effect is the same. They both cause a reduction in oxygen levels in the body. The drop in oxygen creates an “emergency” in the body triggering the “fight or flight” response. This causes the body to release “adrenalin” and other stress hormones. The adrenalin not only wakes you up to breathe, it also raises the heart rate, blood pressure and blood sugar. Up to 50% of people with significant untreated OSA will go on to develop hypertension. Looking at it another way, 25% of people with hypertension have underlying OSA contributing to their condition. Obstructive sleep apnea also elevates blood sugar in people with diabetes, and increases the risk of developing cardiac arrhythmias like atrial fibrillation as well as myocardial infarction, congestive heart failure and stroke. One-third of people with coronary artery disease or myocardial infarction, and up to 50% of patients with stroke have underlying OSA aggravating their health problems.

The awakenings to breathe only last a few seconds. Generally, you need to be awake at least 2 to 3 minutes to process the memory of being awake. Thus, most people are completely unaware that they are stopping breathing or awakening to breathe during their sleep. However, it may be happening hundreds of times per night and can result in significant fatigue and daytime sleepiness. Not all people with sleep apnea will notice daytime sleepiness, but it is sometimes quite severe. Untreated OSA significantly increases the risk of motor vehicle accidents. Some studies have shown that men with moderate or severe OSA may be up to 11 times more likely to have multiple motor vehicle accidents over a 5 year period. Thus, people with significant sleep apnea need to have their condition treated so that they are safe on the road again.

Typical symptoms of OSA are snoring, pauses in breathing, snorting, and gasping. The snoring does not have to be loud and not everyone with OSA snores. In fact, when you are not breathing, you do not snore at all. The person with OSA may be aware of sometimes waking themselves up snorting or gasping, especially when they sleep on their back, but most are completely unaware that it is going on every night. It is the bed partner that is usually the first to become aware of this. However, the bed partner is only aware of the “tip of the iceberg” so to speak because they are usually sleeping too. Thus, the significance and the severity of OSA often goes undiagnosed and unmanaged. In fact, as little as 5% of people with OSA may be diagnosed and only about half of those are treated.

Obstructive Sleep Apnea affects at least 4% of the adult male population and 2% of the adult female population. When woman lose the protective effect of progesterone the incidence rises to 4% of woman after menopause. Some recent statistics put the incidence of OSA as high as 10% of the adult population as the obesity epidemic gets worse. Seventy to 80% of people with OSA are overweight. In particular they have what is called “central obesity” or an “apple” shape due to a big tummy. Central obesity significantly increases the risk of OSA as opposed to the “pear “shape” which is associated with big hips. Eighty percent of type II diabetics are overweight and in particular have central obesity which predisposes them to have OSA. Twelve percent of type II diabetics have moderate to severe OSA. However the incidence rises dramatically to 70% of moderately obese diabetics who snore or are sleepy.

Although 70 to 80% of people with OSA are overweight, 20 to 30% are not. Those that are not may have some underlying craniofacial abnormalities that predispose them to obstruction

of their upper airway. Abnormalities such as a small or recessed jaw will tend to locate the tongue farther back in the airway making it more likely to cause obstruction when the airway relaxes during sleep. Obese people and those with Down's syndrome tend to have large tongues which can also compromise the airway. Large tonsils are a common cause of OSA in children and some young adults. Some people have a very narrow airway at the back of the throat. A combination of a larger tongue or a low lying soft palate can narrow the vertical distance of the back of the throat as well. (Example: Mallampati Class IV in Figure 2) Men with a neck circumference greater than 18 inches have up to an 80% chance of having significant OSA. Even men with muscular necks are at increased risk. One study showed 34% of football linemen had significant OSA.

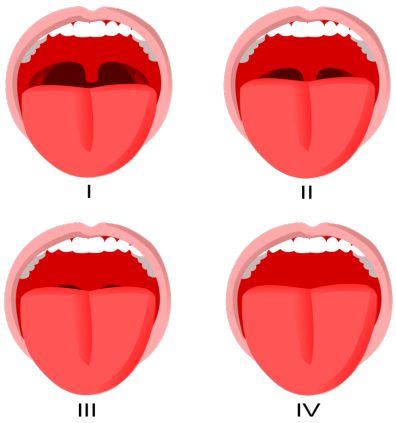


Figure 2

There are various other measurements that can be taken to look at the risk of OSA. The bottom line is that we cannot really tell what is happening to you when you are sleeping by looking at you when you are awake. That is why you need some sort of "sleep study" to measure your breathing during sleep if OSA is suspected.

People with medical conditions such as hypothyroidism or Parkinson's disease are at increased risk of OSA. Those with a family history of OSA are likely to inherit similar anatomy that may predispose them to have this condition as well.

Diagnosis

Because this *Obstructive Sleep Apnea* occurs when you and your bed partner are sleeping, your suspicion for this condition needs to be elevated to make a diagnosis. Obstructive sleep apnea needs to be suspected in anyone with a history of snoring, fatigue, sleepiness or non-restorative sleep associated with pauses in breathing or gasping. The suspicion should be much higher in people who also have hypertension, type II diabetes, coronary artery disease, congestive heart failure, stroke, atrial fibrillation, a thick neck, a small pharyngeal airway or large tonsils.

The *Epworth Sleepiness Scale* is a validated pencil and paper test used to estimate the severity of daytime sleepiness. A score of 6 or less out of 24 is normal, 7 – 10 is consistent with mild daytime sleepiness, 11 – 15 moderate daytime sleepiness and 16 or above is consistent with severe daytime sleepiness.

If the history has raised your suspicion for possible OSA, then further evaluation is required. Under ideal circumstances the best option would be a referral to a sleep disorders clinic for a consultation with a sleep disorders physician. This physician will perform a clinical evaluation, order appropriate testing, make the diagnosis and start treatment. This is especially helpful if there may be other co-existing sleep disorders present such as insomnia that can make diagnostic testing and treatment more complicated. If there are other significant medical disorders such as heart failure, atrial fibrillation or COPD, the underlying breathing disorders may be even more complicated to diagnose and treat due to co-existing *Central Sleep Apnea*.

If access to a sleep disorders physician is limited by distance or long wait times, then the family physician should be able to order testing depending on what local resources are available.

Preparation For Testing

You need to be able to sleep during the testing for the results to be useful. This is particularly important for devices that monitor breathing but do not actually monitor sleep with an EEG. If you remain awake for long periods the study will overestimate the sleep period resulting in underestimating the severity of the sleep apnea. For those with insomnia, a sleeping pill may be necessary to obtain useful results. We use Zopiclone because it has been shown not to make sleep apnea worse. Zolpidem is in the same family of non-benzodiazepine hypnotic agents and is useful too. Benzodiazepine hypnotics like Temazepam or Ativan may suppress breathing a little bit but in normal therapeutic dosages, the affect on determining the severity of obstructive sleep apnea is probably not going to be significant.

A stuffy nose can sometimes make OSA worse. This is because you have to suck harder to get the air through the nasal restriction which may collapse the airway more. If you open the mouth to breathe, the articulation of the jaw causes the tongue to be pushed a little further back and may contribute to worsening the obstruction a little bit too. A stuffy nose will also make it harder to use treatments like Nasal CPAP. In a pinch, an over-the-counter decongestant spray can usually provide immediate improvement in nasal airflow but is not recommended for using more than a few days at a time. If there is time before the study, you can start a prescription for a nasal steroid spray. This takes a few hours to start working and a few days to achieve the full effect but can be used long-term.

Types of Testing There are 4 types of testing that can be used to confirm the diagnosis of OSA. These are:

Level 1 – nocturnal polysomnogram conducted in the sleep lab

Level 2 – portable nocturnal polysomnogram conducted at home

Level 3 – cardio-respiratory study conducted at home

Level 4 – nocturnal oximetry conducted at home

A Level 1 study is the most sensitive and accurate form of testing, especially if other sleep

disorders are suspected in addition to sleep apnea. It is called a “polysomnogram”. The name is derived from the Greek *polus* for “many”, the Latin somnus for “sleep”, and the Greek *graphein* “to write”. This is because the polysomnogram monitors and graphs a number of physiological parameters when you sleep. This includes brain waves (EEG), eye movements (EOG), muscle activity (EMG), heart rhythm (ECG), blood oxygen saturation and chest breathing movements. (Picture 1) Digital video and audio is also recorded. Only a polysomnogram is a true sleep study which actually monitors and measures sleep.

Picture 1

The Level 2 study is also a polysomnogram which monitors the same physiological parameters as a Level 1 but is a portable study usually performed at your home. It is not a readily available test and is used mostly for research.

Level 3 and 4 studies are also portable studies performed usually at home while you sleep. They monitor breathing and oxygen and are useful for diagnosing sleep apnea if they are positive. However, they are not as sensitive a test as a polysomnogram so they do not rule out sleep apnea if they are negative. They are also not “true” sleep studies because they do not have an EEG to actually monitor sleep. The Level 3 is more sensitive than a Level 4 if it is scored by a qualified technician and interpreted by a trained sleep disorders physician. The Level 3 is also able to differentiate between obstructive sleep apnea and *central sleep apnea* if the required chest respiratory effort belt is used. (Picture 2) See the section on *Sleep Disorder Testing* for more information about the different studies.

Picture 2

The severity of the OSA is determined by the number of apneas and hypopneas per hour of sleep. Five events per hour or less is considered within the normal range. Five to fifteen is considered mild sleep apnea. Fifteen to thirty is moderate, and thirty or more events per

hour is considered severe sleep apnea.

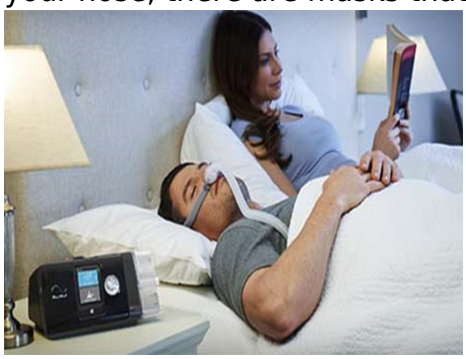
If you are tired or sleepy but Level 3 or 4 testing seems to indicate the sleep apnea is in the normal or mild range, keep in mind that this is likely an underestimate. It is also possible that you may have a different sleep disorder that is making you tired or sleepy. Further evaluation is required with a sleep disorders physician and a nocturnal polysomnogram to more objectively evaluate your sleep.

Management

The effectiveness of various treatment options is influenced by the severity of the OSA. If you have moderate to severe disease, even if you notice improvement with the treatment, it is important that you be tested again on the treatment to document good control of your sleep apnea.

Weight Loss - For some people weight loss may be an option. If you started snoring and having sleep apnea after you gained some weight, it is possible that your symptoms will resolve if you get back down to your pre-snoring weight. However, if the sleep apnea is making you tired, it is also probably slowing your metabolism making it much harder than usual to lose weight. If you are tired or sleepy, it may be better for you to commit to a more definitive treatment so that you feel better sooner. Once you are feeling rested, weight loss is easier. Down the road, if you are able to get to your pre-snoring weight again, you can be retested to see if you still have significant sleep apnea and still require treatment.

Nasal CPAP - CPAP stands for Continuous Positive Airway Pressure. It consists of a small mask that you wear over your nose that supplies air under pressure. The air pressure holds your airway open like a splint so that it does not collapse when you suck in your breath. CPAP is often the most effective way of controlling obstructive sleep apnea especially if it is in the moderate or severe range. (Picture 3) Of course, if you have trouble breathing through your nose, there are masks that go over the nose and mouth too.



Picture 3

There are two ways of initiating CPAP. The preferred way is during a Level 1 polysomnogram in the lab. After you fall asleep with the mask on, the technician gradually increases the pressure in the mask until all the apnea and snoring has been controlled and the oxygen levels have been normalized. Then we know that the treatment is working properly and what pressure you need to be put on at home.

The other way of initiating CPAP is by taking home an Auto-CPAP device. This machine detects when you are snoring or having apnea and automatically increases the pressure

accordingly until the apnea and snoring has been controlled. This machine works well for the majority of people with uncomplicated OSA.

CPAP is not only generally the most effective treatment for all severities of OSA, it is also the only treatment that you can try before you buy it. All the other devices listed below can be effective for certain people, but have to be purchased before you can try them.

Mandibular Advancement Device

A mandibular advancement device is an appliance worn in the mouth that holds the lower jaw forward. This brings the tongue forward so there is more space in the back of throat to breathe. Custom made dental appliances made by trained dentists are effective in about 80% of people with snoring and mild OSA. These appliances may be effective in about 50% of people with moderate to severe OSA. However, we cannot tell if it is going to work just by looking in your mouth. You have to buy the device before you can try it. There are also less expensive “boil & bite” types of devices that may be effective for snoring and mild OSA. Because they are made of softer material and more of a universal fit, they tend to be less durable and bulkier than custom devices. However, if a less expensive “boil & bite” device is effective, then there is very good chance that a device custom made by a dentist will be even more effective, comfortable and durable.

PROVENT

PROVENT therapy consists of a pair of adhesive patches containing essentially "one-way" valves affixed over the nostrils. The large opening on the valve allows unrestricted airflow into the nose. On expiration, the valve partially closes resulting in a build up of air pressure that effectively holds the airway open and prevents snoring or obstructive apnea from happening. PROVENT is usually quite effective for patients with snoring or mild sleep apnea. It is moderately effective for patients with moderate OSA. (Picture 4)

Picture 4

Tongue Retaining Device

A tongue retaining device is made of soft, flexible silicone that fits comfortably behind the lips in front of the teeth or denture. It has on open bulb in the middle that you stick your tongue in. The suction in the bulb holds the tongue forward. This gives you more space at the back of the throat to breathe. It is very simple to use. It is very useful for snoring and mild OSA. It is also an alternative for patients with dentures who cannot use a regular Mandibular Advancement Device. MPowRx is a type of tongue retaining device.

Body Repositioning Device

The Night Shift is a rubber collar with a magnetic clasp on the front and a small, light-weight position sensor and data logger on the back. This device is for patients who have sleep apnea primarily when they sleep on their back as determined by a sleep study that monitors body position. The device monitors body position and vibrates when you turn on your back. This continues until you turn over. The device records your body position as well as how often it has to remind you to turn over. It also records snoring and body movement. Movement helps to determine how often you are awake in the night. The device comes with a USB cable that you can plug into your computer to download the information from the data logger and view in chart format. The charts will show how successful you are at avoiding sleeping on your back. They will also show if there is residual snoring and if you are spending less time awake during the night as time goes on.

Another similar device is called the "SnoreCoach." Instead of a collar, it clips onto the back of night shirt. Instead of plugging into a computer, it downloads to your Smart-phone via Blue-tooth technology.

The Rematee consists of a comfortable, wide belt with pouches on the back for plastic, inflatable cylinders. The cylinders act as gentle barriers to help limit you from rolling over onto your back. Although this device works for some people, it is difficult to monitor effectiveness.

Surgery

In children or young adults with very large tonsils causing significant OSA, tonsillectomy is a reasonable treatment. There are also various procedures available to remove the uvula which is the little piece of tissue that hangs down from your soft palate at the back of your throat. Although some procedures have been promoted as less painful than others, they are all many times more painful that the worst sore throat you have ever had and the pain usually lasts up to 2 or 3 weeks. The “uvulopalatopharyngoplasty” (UPPP) is statistically effective for about 80% of people with snoring or mild OSA, but only about 40% of those with moderate to severe OSA

There are more elaborate forms of surgery that involve breaking the jaw and moving it forward, tacking the tongue forward with sutures, or removing portions of the back of the tongue. The availability of these kinds of procedures will vary from region to region. Jaw surgery may be a more appropriate option if you have a small jaw or other craniofacial abnormalities.