



# Exploring the Different Types of Sleep Apnea and Snoring Dental Appliances

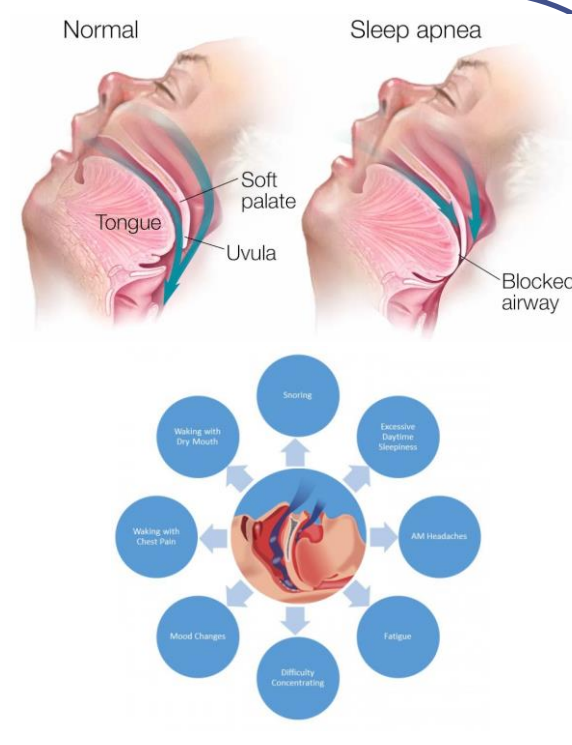
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## Introduction to Sleep Apnea

- **Sleep Apnea** is a medical respiratory disorder that occurs during sleeping and is manifested by apneic episodes, due to the blockage in the airway.
- It is classified as **Central, Obstructive** and **Mixed Sleep Apnea**.
- **Central Sleep Apnea** is defined as when the brain does not signal the muscles controlling the breathing. This type occurs mostly in older people, stroke and heart disorder patients, and is more common in males than females.
- **Obstructive Sleep Apnea**, which is most common, occurs when the muscles in the back of the throat are relaxed.
- **Mixed or Complex Sleep Apnea Syndrome** is defined as a combination of both Central and Obstructive form of sleep apnea.
- The sleep apnea severity is determined by the Apnea-Hypopnea Index, measuring the average occurrences of breathing stops plus the number of periods of shallow breathing.
- The AHI is calculated by dividing the number of occurrences by the number of sleep hours.

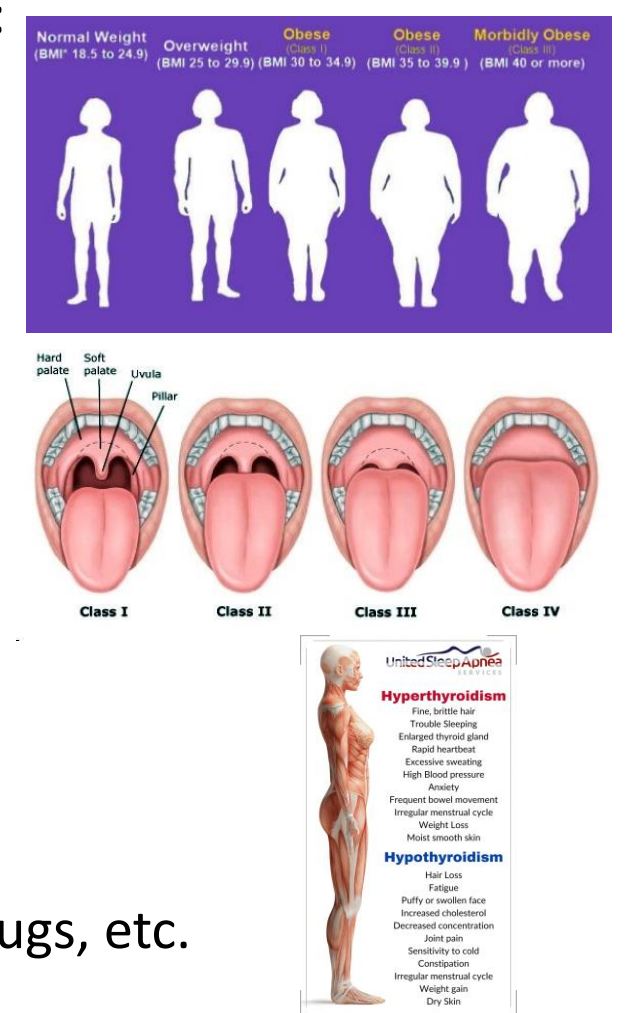


| AHI   | Rating                  |
|-------|-------------------------|
| <5    | Normal (no Sleep Apnea) |
| 5-15  | Mild Sleep Apnea        |
| 15-30 | Moderate Sleep Apnea    |
| >30   | Severe Sleep Apnea      |

## Symptoms and Causes of Sleep Apnea

- **Symptoms**
- There are different symptoms associated with this disorder, such as: snoring, sleep walking, daytime sleepiness, irritability, difficulty concentrating, and morning headaches.

- **Causes**
- **Obesity** is the leading cause with 60% of people diagnosed with this respiratory disease, because gaining weight narrows the airways. Recent studies show "that a 10% increase in weight can equate to a six-fold increase in OSA risk."
- **Anatomical characteristics** of a person's neck, jaw, tongue, tonsils, etc. which directly impact the airflow.
- **Hormone deficiencies** and irregularities such as hypothyroidism (under active thyroid) and acromegaly (excess growth hormone).
- **Medications** used by patients for treating pre-existing conditions
- **Lifestyle choices** such as smoking, use of alcohol, use of sleeping drugs, etc.



## Consequences of Undiagnosed and Untreated Sleep Apnea and Statistics in the USA

### Clinical Complications

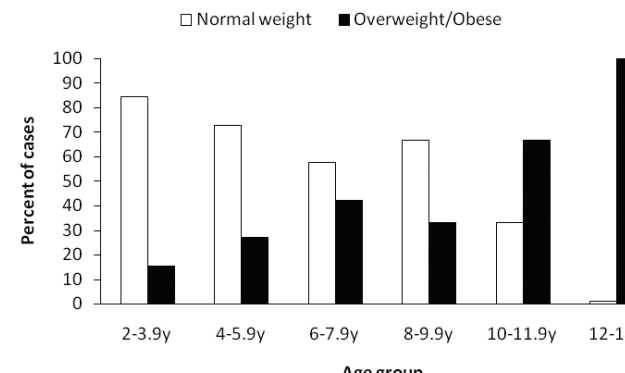
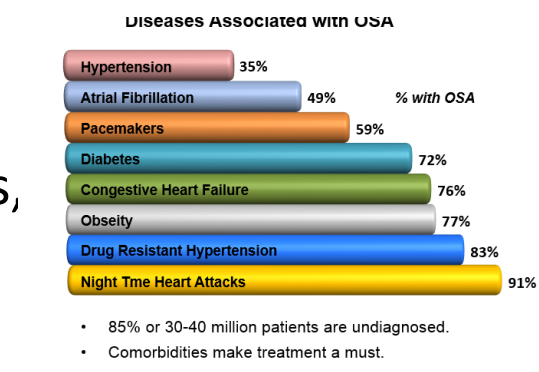
- Undiagnosed and untreated sleep apnea can lead to health complications such as cardiovascular diseases, heart attacks, heart diseases and strokes because the body is deprived of the normal levels of oxygen. In addition, sleep apnea can increase the risk of developing insulin resistance and type 2 diabetes.
- For patients that are under medication or need surgeries they are more likely to develop complications because they are predisposed to breathing problems, especially during medical procedures.

### Lifestyle Complications

- Increased stress on the person's relationship with significant other
- Reduced time reaction in unpredictable situations
- Decrease job efficiency/performance

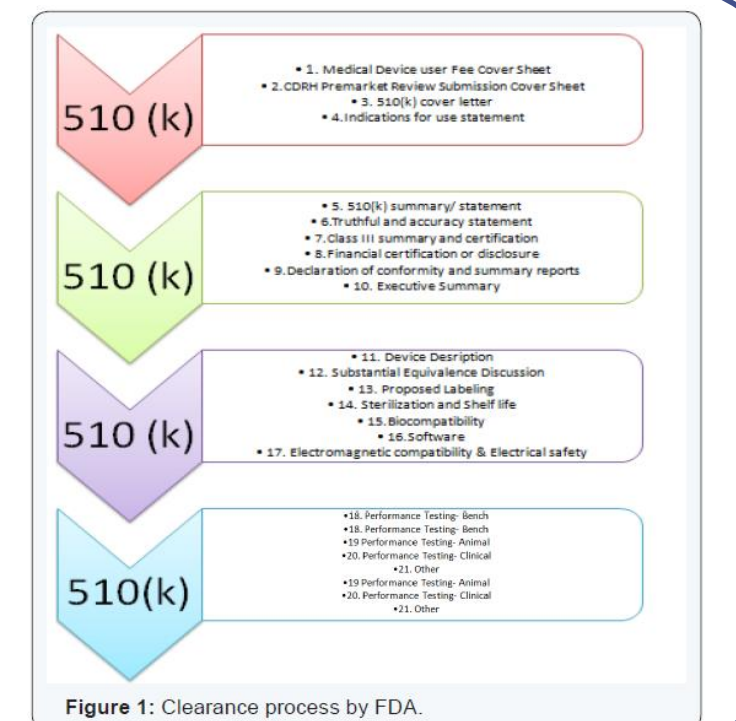
### Sleep Apnea Statistics in USA

- According to the American Sleep Apnea Association, approximately 22 million people living in the USA are believed to suffer from sleep apnea, from which 80 percent are undiagnosed.
- Moreover, the Sleep Apnea Foundation estimates that between 1 to 5 percent of children suffer from Obstructive Sleep Apnea, with many of them being underdiagnosed.



## Treatments using Dental Appliances

- Even though the primary choice for treating patients that suffer from sleep apnea is the Continuous Positive Airway Pressure Therapy or CPAP machines, for more mild cases of Obstructive Sleep Apnea, dental appliances are getting more attention from the dental industry and patients.
- All dental appliances prescribed by doctors and dentists and manufactured in the dental laboratories or specialized dental appliances manufacturers must have the Food and Drug Administration (FDA) 510k, Class II approval, because they come in contact with the patient's body.
- FDA 510k Class II refers to medical/dental devices that come into contact with the patients and according to FDA "devices for which general controls are insufficient to provide reasonable assurance of the safety and effectiveness of the device."
- Recent studies suggests that patients with less severe sleep apnea will prefer dental appliances instead of the CPAP machines, because they are more comfortable for patients during sleeping, are easier to maintain and clean and they are less expensive.
- According to Almeida, F. R., et Al, (2013), "In summary, the current literature increasingly supports MAS as an effective alternative to CPAP except for extremely and morbidly obese persons."



## Types and Characteristics of Dental Appliances for Sleep Apnea:

### Main Types of Dental Appliances for Sleep Apnea:

1. **Mandibular Advancement Device** or MAD pulls the mandibular jaw forward, opening the airways. There are three types of MAD:
  - (a) **Fixed advancement or non-adjustable** are the over-the counter devices that patients can soften in boiling water and molded over their teeth and as it cools it becomes hard. They are cheaper and somewhat convenient, but they might fall out or move in the mouth during sleeping because of low retention, therefore not very effective.
  - (b) **Adjustable advancement one piece**, are custom designed dental appliances where the dentist takes impressions of patients' upper and lower jaws including the bite registration and send them to be fabricated in the dental laboratory. These devices can be one piece (Monoblock), where the upper and lower parts are fused together.
  - (c) **Adjustable advancement two-piece device**, where the upper and the lower parts are separated but connected by rods, allowing certain jaw movement and they are the most effective.
2. **Tongue retaining devices** moves the tongue forward to free the blocked airway. It is a one piece, upper and lower parts connected, but with a customized tongue protrusion piece.
3. **Combination of MAD and CPAP**, custom-made dental appliance attached to the CPAP machine, lowering the pressure in the CPAP make it more comfortable for the patient, used in more severe cases of sleep apnea, but not for treating central sleep apnea.



### Characteristics of Dental Appliances for Sleep Apnea:

1. For bruxism-the dental appliance has additional metal attachments that allow more lateral movement, and the upper and lower parts can be lined with softer material.
2. For lateral shift-lateral-the dental appliance had additional fins attached to the lower part limiting the upper part lateral movement
3. Maximal protrusion or the distance is necessary to clear the airway, it is estimated between 50% to 80% of the patients' mandibular protrusive movement.
4. For patients with missing teeth wearing Removable Partial Dentures, the dental appliance is customized to fit over the RPD.
5. For patients that have edentulous arches, or no teeth-The dental appliance engages the alveolar ridge, the buccal and lingual sulcus for retention, and restrains laterally the masseter muscle increasing the air flow.

## Methods and Materials

### 1. Analog or traditional manufacturing method

- Impressions and bite registration (in mandibular protrusion) taken by the dentist are used fabricate the stone models, which are articulated to register patient's the vertical dimension, the lateral and protrusive movements.
- Adam, pinhead clasps and expansion blocks are processed posteriorly into the for better retention and space for inserting the screws' key. This allows for increasing or decreasing the mandibular advancement protrusive distance.

**Materials:** Clear heat polymerized acrylic resin, Triple Laminate with a soft liner, ThermAcryl, casted or prefabricated metal attachments.

### 2. CAD/CAM or digital manufacturing method

- An intraoral scanner is used to scan of both arches including the bite registration.
- The patient's case/file is sent to the dental lab where specialized technicians using design and manufacturing software fabricate the dental appliance for sleep apnea.

**Materials:** Vacuum form materials, nylons, 3D printing resins, clear polymethyl methacrylate.

### 3. Combination of both methods

## Results And Conclusion

- For moderate to mild sleep apnea such as obstructive sleep apnea, the dental or oral appliances are a viable solution because they are better tolerated by patients, are cheaper and easier to maintain or replace.
- Among the dental appliances for sleep apnea, the most profitable are the digital generated ones, because the materials used in fabrication are more stable and are faster to be manufactured and delivered to patients, with less adjustments at chairside.
- Another advantage of using dental appliances is that they can be used to treat Bruxism, and to be customized to fit patients' anatomical characteristics.
- As previously presented, even for more complicated cases, the dental appliances can be used in correlation with the CPAP units.
- Also, the versatility of design, from basic to more complex appliance, gives the patients a way to improve their health and well-being.
- Currently, more studies and research are being conducted to find the long-term effects on using the dental appliances for treating sleep apnea, therefore new updates are coming soon.

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