

Sleep Disordered Breathing

Its Impact on Health

The Dentist's Role in Its Management

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SLEEP

To understand the impact of disordered breathing during sleep we must understand the relationship of normal sleep to health. Normal, healthy sleep is a physical and mental resting state in which an individual is relatively inactive and unaware of the environment. Sleep, on average, requires 1/3 of each day and includes six hours of non-REM sleep and two hours of Rapid Eye Movement (REM), dream sleep.

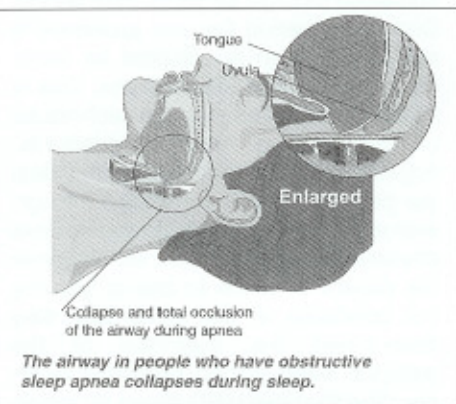
Non-REM sleep consists of four stages. Stage one, a transition period from wakefulness to sleep, is a very light sleep from which one is easily awakened; it constitutes 5% of sleep time. Stage two is light sleep and makes up 45-50% of sleep time. During Stage three, the initial part of deep sleep (10-12% of sleep time), it is difficult to arouse the individual. Stage four, the second part of deep sleep (10-13% of sleep time), is characterized by very deep sleep. When awakened, individuals appear groggy and disoriented. An example of this is when a child lies limp in your arms, sound asleep. Stages three and four together are referred to as delta slow wave (the brain wave pattern measured during this time) sleep. It constitutes 20-25% of the sleep of normal healthy adults and is often comprised of mainly stage three.

REM sleep, characterized by rapid eye movement and eyelid fluttering, muscle paralysis, decreased body temperature, irregular breathing and changes in both heart rate and blood pressure, occupies 20-25% of the healthy sleep cycle. This is the time when individuals dream; while the physical body is restrained, the mind is released. This stage is considered to be a refreshing segment of sleep.

In healthy individuals a night is composed of four to five cycles which include the four stages of non-REM and REM sleep. The cycles last from 90-100 minutes with the relative proportion of REM time increasing until 4:30-6:30 A.M. These cycles, with the various proportions of the different kinds of sleep, are referred to as the "sleep architecture" of

a normal healthy person. Disruption of this "healthy" sleep architecture results in sleep deficit and the subsequent sleepiness. Individuals vary in the need for sleep. If you get your required amount of sleep at the right time, which is determined by your internal circadian clock, you wake up refreshed and alert. If you don't get the sleep you require, your internal clock will put you to sleep even during the day. You might off-set the effect with physical exercise, extreme concentration or stimulants, but even then, with the slightest relaxation, you will be overcome by sleep.

Sleep-related breathing disorders, brought about by the deprivation of oxygen and the body's struggle to take in breath, fragments the sleep architecture and forces the individual into an excessive amount of time in lighter stages of sleep at the expense of deeper delta and REM stages. This results in excessive daytime sleepiness (EDS) for the individual. The consequences of EDS include fatigue, depression, family discord, poor job performance, decreased quality of life, increase in motor vehicle accidents and work-related accidents. Sleep related breathing disorders also impact upon the cardiovascular system with physiologic sequela of asphyxia: hypoxemia, hypercapnia and acidosis. Further complications include hypertension, cardiac dysrhythmias, myocardial ischemia and hypotension (in older adults).



SLEEP-RELATED BREATHING DISORDERS

Sleep related breathing disorders form a continuum ranging from benign snoring and upper airway resistance

syndrome, to severe obstructive sleep apnea. Apnea is defined as cessation of breathing for ten or more seconds. Hypopnea relates to a 30-50% reduction in airflow for ten or more seconds. There are three patterns of apnea.

Obstructive apnea is the absence of airflow despite persistent breathing efforts. Central apnea is the absence of airflow due to lack of breathing effort.

Mixed apnea is a combination of central and obstructive apnea with a central pattern evolving into an obstructive one.

The vibration of the pharyngeal soft tissues creates snoring as air passes through an airway that is too small to allow for smooth, unimpeded flow. Some instances of loud, regular snoring, due to the exaggerated breathing effort and high resistance to airflow, result in repetitive sleep arousal. This condition, referred to as upper airway resistance syndrome, gives rise to the symptoms described above that are most often attributed to obstructive sleep apnea. In addition, the term "silent apnea" describes a condition where snoring has been silenced through treatment but apnea symptoms persist.

The collapse and/or narrowing of the upper airway associated with sleep related breathing disorders is due to:

- Pre-existing disproportionate anatomy from the nose to the glottis
- Pharyngeal flaccidity from decreased airway dilator muscle tone
- Negative intrapharyngeal pressure resulting from increased inspiratory resistance.

MANAGEMENT OF SDB

Management of sleep disordered breathing (SDB) can be either general or site specific. General approaches require avoidance of risk factors which include obesity, sleeping supine, eating excessively or drinking alcoholic beverages late at night, taking sedative-hypnotic medications and hypothyroidism. They also include the administration of medications such as protriptylene, which are not very effective. The gold standard of the general treatments is positive airway pressure that is most often delivered nasally in a single fixed pressure. More advanced versions of this deliver the air

at bi-level pressure (inspiration and expiration) and are automated to adjust to changes in the patient's unstable airway.

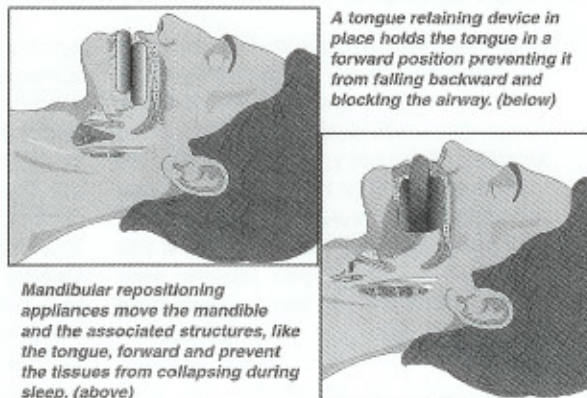
Site specific approaches refer to the disproportionate anatomy and the airway muscle dilator tone. Surgery can impact the anatomy through the removal of, first, excessive soft tissue of the nasal and oral pharynx, including lateral and posterior walls of the oral pharynx through uvuloplasty (UP) or uvulopalatopharyngoplasty (UPPP) and, second, the base of the tongue through base resection. It can modify tongue position by altering the position of muscle attachments. Surgery can correct hard tissue obstruction such as that of a deviated nasal septum, it can bypass soft tissue obstruction through tracheostomy procedures and it can change tongue and palate position through jaw advancement surgery. Surgery is essentially irreversible.

THE ROLE OF THE DENTIST IN SDB

Oral appliance therapy is a non-surgical approach to management of tongue position. It prevents the base of the tongue from collapsing and obstructing the upper airway. Oral appliances may function in three basic ways: (1) by repositioning the mandible (lower jaw), tongue, and hyoid bone; (2) by stabilizing them; and (3) by increasing baseline genioglossus (tongue) muscle activity.

The dentist who is involved in the treatment of obstructive sleep disordered breathing is faced with all of these complex issues. He or she must have a working knowledge of various sleep related breathing disorders, other related sleep disorders, their diagnosis, management and treatment, the limitations and side effects of treatments, and more than sixty oral appliances available for use in oral appliance therapy. There are two types of oral appliances that have demonstrated effectiveness in the treatment of obstructive sleep apnea: tongue retaining devices (TRD) and mandibular repositioning devices (MRD). Of these, the MRDs are most numerous and have more design variations. The challenge in therapy is to find, fit and manage the most appropriate appliance for each patient. These appliances, by virtue of their type and design variation, can produce different side effects. Some side effects, such as alter-

ation of the tooth and jaw position, are often irreversible. Others, such as transient jaw or tooth discomfort, soft tissue impingement, excessive salivation and dry mouth, are often reversible.



The dental practitioner who is knowledgeable about oral appliance therapy takes a sequential three step approach to treatment. The first step, diagnostic in nature, determines if the patient is a candidate for oral appliance treatment, and if so, which type and design. Trial procedures, whereby a patient tries a generic design TRD and/or MRD are undertaken to see how the patient responds to each type of appliance. Comfort, effectiveness and side effects are monitored by recording with an observing person, and the patient. This trial information determines whether a TRD or MRD is indicated, as well as, the design variation and type of material for the appliance construction. This often narrows the appliance selection to one or two choices. The second step involves making, then fitting the appliance to the patient, who wears the appliance through an adaptation period. During this period the oral appliance fit and jaw position is adjusted for maximum comfort and effectiveness. This is initially determined through techniques utilized during trial procedures. Adjustable MRDs are titrated to the ideal jaw position. This is confirmed through evaluation by a qualified sleep disorders physician who, most often, will diagnose the patient while he or she is wearing the appliance in the same way they determined the diagnosis of the patient's sleep related breathing disorder. One titratable MRD allows for movement of the jaw to an ideal position while the patient is asleep and undergoing an "overnight sleep study". With confirmation of appliance effectiveness, the patient will wear the appliance and enter

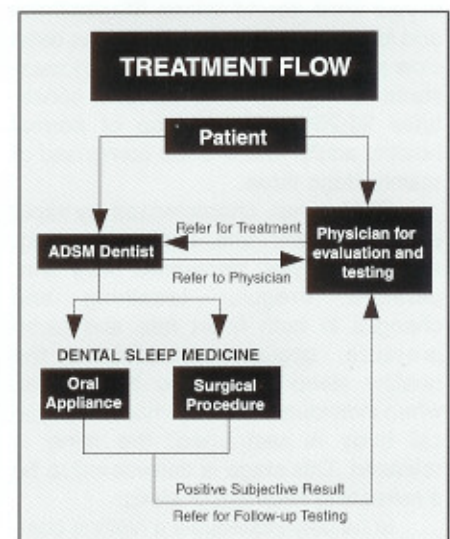
the final step in their therapy. This includes periodic re-evaluation by the dentist, who is looking for side effects like early changes in tooth or jaw position and changes in the gums or other mouth tissues that are being provoked by the oral appliance. This stage includes examination of the physical condition and fit of the appliance so as to make alterations or recommendations in its use and care. The third step also includes evaluation of appliance effectiveness by the patient's physician associated with the management and oversight of their sleep disordered breathing, or their sleep disorders dentist, serving as the physician's agent.

Oral appliance therapy is both challenging and rewarding for the dentist who must work in close coordination with the treating physician. This treatment can be complete in itself or it can be accomplished in tandem with surgical and non-surgical treatments. It both impacts and is impacted by the patient's general health and well-being.

More extensive information about oral appliance therapy, or locating a dentist with a special interest in this treatment can be found at the Academy of Dental Sleep Medicine website:

www.dentalsleepmed.org

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Sources of Information

"Educational CD-ROM, Academy of Dental Sleep Medicine, 2002. Academy of Dental Sleep Medicine, 10592 Perry Highway, #220, Wexford, PA, 15090-9244"