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Protocol for Primary Treatment of Snoring by Dentists

Why a Protocol

Doctors usually arrive at diagnoses and treatments using an amorphous thought process that lacks structure, and is based largely on pattern recognition and past clinical experience. Clinical decision-making arrived at by a progression of well-reasoned steps may take more time, but arrives at more logical conclusions and is easier to teach as a new discipline to students who have little or no experience. Strategies for chunking, organizing and prioritizing information also help sharpen doctors' reasoning skills.

Psychological studies of scientists demonstrate strong evidence of cognitive limitations that lead to frequent judgment error and a very limited ability to deal with complex information. When making clinical decisions, doctors' brains have a very limited ability to manipulate more than four to five variables. Crude non-optimized flow charts have repeatedly been shown to be more reliable than subjective human judgment.

A new range of treatment is being proffered to the dental profession – treatment of benign non-apneic snoring. A flow chart creates a framework for conceptualization of the problem and reliable stations for sequential decisions in a logical progression.

Why a Protocol for Snoring

Snoring is defined as obstructive sleep breathing. Snoring is caused by diffuse vibrations or fluttering of pharyngeal tissues during sleep. The pathogenesis of snoring is vibrating tissues accompanied by increased collapsibility and incomplete pharyngeal obstruction or narrowing of the pharyngeal airway. The three necessary conditions for snoring are vibrating tissue, flow limitation and sleep. Snoring usually occurs on inspiration but can also occur on expiration. Snoring can occur during exclusive nasal breathing, exclusive oral breathing or combined oronasal breathing.

Airflow velocity during snores usually exceeds that of noiseless sleep breaths. All people during sleep have increased inspiratory suction pressure, fast turbulent airflow, increased palatal resistance, negative inspiratory suction and prolonged inspiratory time. Snorers during snoring have a greater magnitude of these changes. The relevant physiological parameters in snorers compared to non-snorers are upper airway diameter, cross sectional area of the pharynx, pharyngeal shape, pharyngeal collapsibility, nasal and pharyngeal resistance to airflow.

The noise of snoring is certainly disruptive and annoying. Everyone seems to know a snore when they hear one, but as of August 2008 no gold standard definition of a snore by objective measurement has been developed. Objective measurement of snoring has proven difficult. Spectral analysis reveals a rich complex sound. Attempts to model snoring as coming from a point-like location have proven futile. Objective measurement tools to localize the originating site of snores have not been devised.

Defining snores as a sound have posed more complex problems. In terms of signal analysis, interpretation, unique vocal tract characteristics and ideal receiver placement have presented daunting obstacles. According to Victor Hoffstein, renowned author of several seminal treatises on snoring, there are no studies validating the electronic measurement of a sound scored as a snore by a PSG technician, by a computer or its perception as a snore by listeners.

A further problem unique to snoring is that the snorer is usually unaware of the problem, and the initial complaint is that of the bed partner or listener of the snoring. The relationship between nasal resistance and snoring is also complex. When both are measured simultaneously during sleep, no consistent temporal correlation is found between nasal resistance and snoring.

Any membraneous part of the upper airway from the nose to the epiglottis that lacks cartilaginous or bony support may vibrate. Examples of such structures with vibrating potential are swollen nasal membranes, soft palate, faucial pillars, pharyngeal walls, tonsils, adenoids, uvula and tongue.

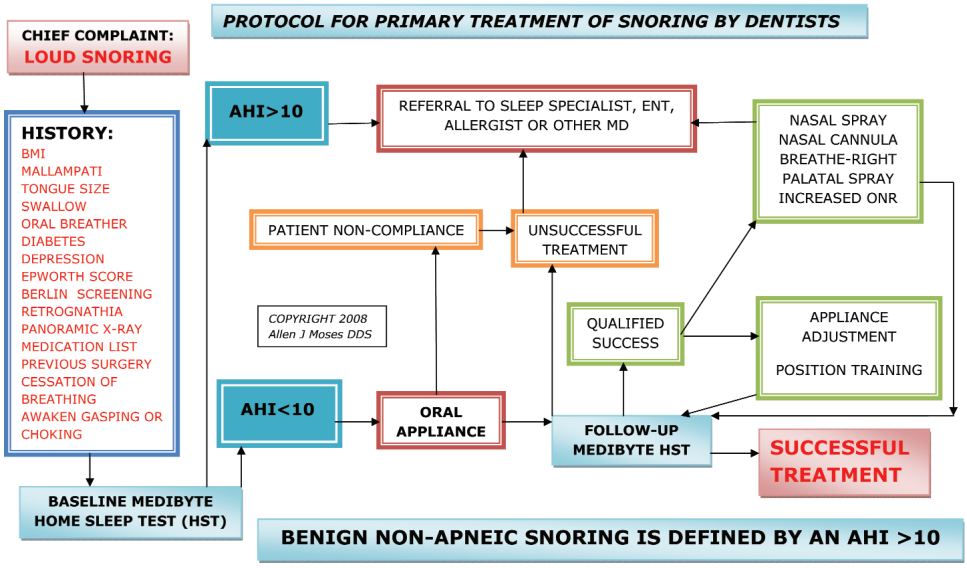
The health consequences of snoring range from none (benign clinical sign) to severe sleep disturbance with morbid consequences, in patients with obstructive sleep apnea. While snoring usually accompanies OSA, snoring by itself provides a very low diagnostic predictability for OSA. In a study of a group of patients who snored, suspected of having OSA and tested with polysomnography, more than 50% had an AHI less than 10. Snoring, taken alone as a symptom, has a very low diagnostic accuracy to predict sleep apnea.

Hoffstein regards an AHI<10 in the absence of OSA symptoms such as nocturnal cessation of breathing or awakenings with gasping or choking as the cut-off defining non-apneic, benign snoring. No studies have implicated benign non-apneic snoring as being an increased risk factor for hypertension, vascular disease, heart attack or stroke. Repeated studies have failed to support an association between benign non-apneic snoring and decreased daytime cognitive function. Daytime sleepiness however, is frequently observed in benign non-apneic snorers. It has been attributed to sleep fragmentation, as a result of snoring arousals, but the arousal frequency did not correlate to amplitude or frequency of snores.

So let's summarize about snoring. We have not scientifically defined it. We still don't know how to measure it. We do not know exactly where it comes from. No treatment always works. Treatment is usually not even directed at the snorer. As we shall see, success of treatment is even hard to define. It is not like dentistry does not know much about snoring – current medical science does not know any more.

Why Dentists Should Treat Benign Non-Apneic Snoring (BNAS)

Dentists are given courses in dental school on respiratory physiology, oral anatomy, swallowing, tongue function, orthopedic repositioning of the jaws, and oral prosthetics. Dental education teaches about the morbidity and consequences of OSA, diabetes, depression, and obesity. Dental students are schooled



in taking a good medical history and understanding the significance of their findings. Dentists already do a cancer screening as part of a routine dental examination. They are already looking at the same anatomic structures used to determine a referral for diagnosis of OSA and signs that suggest a patient may be snoring. Further, they are examining these characteristics based on a higher level of formal training than most physicians receive in this area. It is logical and sensible that dentistry as a profession should be among the very best screeners and referrers of OSA patients to sleep specialists.

Dentists make oral appliances as a result of their professional training and the scope of their license. No other health professional is trained or licensed to make oral appliances. Oral appliances for benign non-apneic snoring are the least invasive, highest compliance and most comfortable of the effective treatments available. Also significant is the fact that benign non-apneic snoring does not have anywhere near the morbidity of OSA.

Dentists are not trained to treat or deal with the morbid medical consequences of OSA such as heart attack, stroke, diabetes, cognitive dysfunction and depression. Dentists are not trained to manage CPAP or do oral/nasal/palatal surgery. The key question is whether dentists are qualified to make the differential diagnosis, "*Benign non-apneic snoring or OSA?*"

Making the Differential Diagnosis and Evaluating Treatment Outcome

In oral appliance therapy for snoring and sleep apnea, a reliable ambulatory testing device to establish baseline OSA levels and evaluating treatment outcome is an essential requirement. Ideally an ambulatory PSG device would measure obstructive apneas, central apneas, mixed apneas, hypopneas, oral/nasal airflow resistance, AHI, desaturations, blood oxygen level, pulse rate, body position, and snoring.

One such device is the Braebon Medibyte, an FDA approved miniature 12 channel Class 2 ambulatory polysomnographic recorder. The patient easily connects an abdominal belt, a chest belt that holds the recorder, a nasal/oral cannula, a pulse oximeter and a tiny snore microphone. They sleep in the comfort of their own bed at home.

The software allows the doctor to evaluate the entire study, rescore any events or accept the computer interpretation. It records snores in decibels and allows the user to click and listen to any snore or series of snores desired. The Medibyte is unique among ambulatory PSG units in that it records snoring at a high enough sampling rate to allow spectral analysis of the snore sound from 0 – 1000 Hz. As such, it is also a valuable research tool. The cost of the Medibyte is very reasonable, the cost per study for expendables is cheap and the reliability is excellent. The data is presented in a language that facilitates excellent communication and reports to referring doctors. It allows a clinician to practice at the state of the science and retest patients as frequently as needed to get it right.

A baseline recording is taken on all sleep/snoring patients as the initial measurement against which treatment outcome can be evaluated. A second recording is done two to three weeks following delivery and fitting of the oral appliance, when the patient has had sufficient time to adjust to wearing their intraoral device. Subsequent recordings are done after each appliance adjustment.

Treatment results of oral appliances on benign non-apneic snoring can be objectively measured. Frequency of snores, loudness of the loudest snores, average loudness of snores, and number of snores per hour can all be measured. The problem of patients with benign non-apneic snoring may not be the effect of snoring and the appliance on them but on their sleep partner. Reduction of frequency and loudness of snores may not be as meaningful as the sensitivity of the sleep partner. How good is their sleep quality? How far away do they sleep? How good is their hearing? How big is the bed? There is no gold standard to objectively measure treatment success for snoring.

Defining Successful Treatment of Benign Non-Apneic Snoring

On the flow sheet for diagnosis and treatment of benign non-apneic snoring we should logically be able to say that treatment outcome is either unsuccessful, is a qualified success or successful. The difficulty is defining these outcome possibilities. Criteria and standards based on physiologic validation obtained by objective measurement is an ideal. In sleep medicine many definitions are arbitrarily set and not based on scientif-

ically validated parameters. The definition of "CPAP compliance" is arbitrarily set. The parameters defining mild, moderate and severe obstructive sleep apnea are arbitrarily set. Research criteria for success of oral appliance therapy for OSA, 50% reduction of AHI, AHI below 10, or both, are arbitrary. Rejection of payment for UARS by insurance companies and rejection of payment for OSA if the AHI is below 10 are arbitrary and not based on any scientific criteria.

There are numerous possible criteria for evaluation of successful treatment of benign non-apneic snoring. Some are subjective. Some are based on objective measurement. All are arbitrarily set standards.

Subjective Criteria

- Patient is comfortable with their appliance
- Patient is compliant wearing their appliance
- Patient reports a subjective improvement in sleep quality
- Patient's bed partner is satisfied

Objective Criteria

- Patient snoring is worst when sleeping supine, position training is appropriate
- Reduction in loudest decibel score
- Reduction in average decibel score of snores recorded
- Reduction in number of **snores recorded above 65 decibels**
- Reduction in number of events of resistance to oral / nasal airflow as measured by the pressure transducer in the cannula.

Discussion

In an ideal world the subjective criteria could be scored on a visual analog scale (VAS), graded 1 – 5. Numeric values of 1 – 5 could also be assigned for the scoring of objective criteria and a scale devised such as the *Epworth Sleepiness Scale*. It is the opinion of this clinician that a scale is not appropriate for evaluation of therapy for snoring. The state of sleep science is such that snoring is too heterogeneous a problem for a single number to represent all the factors necessary to determine success at treatment of snoring. There is an ongoing debate in the sleep community whether snoring is under central control or peripheral mediation by anatomic characteristics. Snoring is a complex multifactorial problem whose etiology may vary from patient to patient.

Should research scientists devise a study to test the minimum snore loudness in decibels that cause arousals in a population of snorers? The results would most likely fall into a Bell Curve. An average score on such an objective study would not be representative of a successful treatment standard for many snorers. Also the study would have to be repeated on the sleep partners of the snorers because it is often their arousal level that determines both the need for therapy and the measure of success of the snoring therapy. Hearing acuity varies in a population as well as physiological arousal level from snores. The uniqueness of each patient's physiological and anatomic characteristics, the limitations of scientific knowledge of snoring and the limitations of each available therapy must be appreciated in determining clinical success.

Defining successful treatment of snoring is an elusive concept. Physiological perfection is not an easily attainable goal. Present therapies do not cure patients of the etiological factors causing the snoring. Success of treatment is mutually agreed upon on an individual case basis by clinician and patient, and in many cases the sleep partner. The operative word is often satisfaction. Trial and error, patience by the clinician and patient and confidence in the relationship are all variables determining satisfaction. "*Qualified success*" reflects improvement in criteria before all possible alternatives have been tried and evaluated. Successful treatment using "The Protocol" is based on maximum improvement attainable using an oral appliance. The clinician and patient should be satisfied and agree that all possible alternatives have been tried. Following "The Protocol" assures thoroughness that all paths are explored. "The Protocol" is merely a roadmap.

Summing it Up

There is no convincing evidence that benign non-apneic snoring will predictably advance to morbid health consequences as a continuum in the progression of OSA. "The Protocol" is a guide and reminder that snoring is a complex, heterogeneous problem that may require involvement of multidisciplinary health care specialists. There is no one therapy that always works to control snoring. The success of oral appliances for treatment of snoring is a well-documented fact. Dentists having the correct measurement devices and training are logical health care specialists for diagnosis and treatment of benign non-apneic snoring. Following this protocol, dentists involved in the diagnosis and treatment of benign non-apneic snoring should also be the best resource for referral of OSA patients to sleep specialists.

Allen J. Moses, DDS, DABCP, DABDSM is the Professor of Rush University Medical School's Department of Sleep Disorders in Chicago, Illinois; a Diplomat of The American Academy of Dental Sleep Medicine; and a Diplomat of The American Academy of Cranial Facial Pain.