

Home Video to Assess the Snoring Child

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Consider the following case: a 5 year-old child who snores and constantly wakes-up every night, breathes through the mouth during the day, has to pause mastication to breathe, has frequent acute pharyngitis and tonsillitis, delayed growth. The child is referred by the Pediatrician because he thinks medical possibilities have been exhausted, and under examination you find enormous tonsils that touch each other in the midline.

Most physicians would agree that tonsillectomy and adenoidectomy would provide a dramatic positive change in the child's quality of life. At the other end of the possibilities spectrum, parents sometimes just mention that the child has no daily symptoms or frequent regional infections and they want to know whether they should be concerned or not.

Snoring is generated by the pharyngeal walls rubbing during respiration. This rubbing could occasionally become very intense and compromise the airflow, even with periods of total obstruction (obstructive apneas), leading to inherent negative consequences on the child's health. This problem is known as Obstructive Sleep Apnea Syndrome (OSAS). In children, it is widely accepted that after ruling-out treatable medical conditions, such as rhinitis and other less frequent tumoral or anatomical problems, adenoidectomy and tonsillectomy are effective in the majority of cases.

Sometimes it is very difficult to determine whether a child suffers from OSAS or not. Polysomnography is the gold standard test, performed during sleep, monitoring different cardiorespiratory and neurological variables, using a complex and expensive equipment. This test normal and abnormal values have been established based on statistical criteria, and the correlation between these values and the probability of developing OSAS is still unknown. In other words, we are just starting to understand OSAS (described in children in 1976 for the first time), and changes in the definition can be expected as we learn how and when this nocturnal respiratory problem affects function and development in children.

In Costa Rica, the access of patients to polysomnography (PSG) is very limited, due to economical reasons and the lack of Sleep Laboratories. Therefore, the decision to operate on OSAS is made without PSG. There is no well-defined rigid line to separate children who need a tonsillectomy and adenoidectomy for this indication from those who don't, even with PSG. Decisions are made according to the surgeon's clinical judgment, after weighing the health consequences, the findings of the physical examination and the X-ray and laboratory results, the

patient's general health condition and procedural risks. It is odd that surgical decision making must sometimes be made solely based on what the parents tell about the child's sleeping behavior, as it can be difficult for them to describe and assess the severity of the symptoms. They can even exaggerate the overall picture to make sure the physician will not underestimate the situation, because of their fears after hearing someone saying that "they should be careful, given snoring could be very dangerous".

Many otolaryngologists have never observed an obstructive sleep apnea, and their knowledge about the normal and pathological respiratory sleep pattern is often insufficient. To help coping with this gap, you may use videotapes of sleeping children, taped by their parents whenever possible, taking advantage of the ever increasing availability of video cameras (conventional, digital and those built-in in mobile phones). Thus, the physical examination is virtually extended to the sleeping child's bed. This is not a new practice, as in the last years some authors have published papers using audio and videotapes taken at home or sleep laboratories. These recordings are of great help for a better understanding of the problem, for decision-making based on direct observation, and even to improve history-taking in cases where taping is not possible.

To optimize the video usefulness, the author provides parents with a small pamphlet, instructing them, among other things, to correctly videotape the situation. Those instructions are detailed as follows:

- A short video (2 to 3 minutes) is shown during the outpatient appointment, with examples of finding suggestive of OSAS. This is useful even when the video recording is not possible, because parents can now compare their child's respiratory pattern, and give a better description of the problem in the next visit.
- Parents are asked to observe the child's sleeping behavior at different hours over several weekdays before doing the videotape.
- For recording purposes, it is recommended to use video with sound. Even an audio recording is useful, but video without sound is not acceptable, as it is the breathing sound that will allow you to infer about the respiratory flow.
- It is better if the child sleeps with a loose t-shirt that can be lifted during the recording, so the presence of thoracic retractions can be observed.
- We suggest that the take only includes the head, the neck and the chest, frontally, without close-ups and with as little movement of the camera as possible.
- It is useful if the camera has infrared vision capability, to tape in the dark and minimize disturbing the child during sleep.
- The recording should be made in the absence of an acute respiratory infection.
- If the child has chronic rhinitis, he/she must be under optimal treatment. Based on the few bibliographical references and the limited experience reported, the author listed the issues to qualitatively assess the recordings.
- How difficult was it to get the video? Sometimes parents come back without the video, arguing that after observing the child during a whole month, no

snoring or respiratory distress ever took place. A possible explanation is to consider that the parents overreacted to the child snoring during acute respiratory infection bouts, which is not a justification to support the need of surgery.

- After observing the child during sleep, parents usually are able to better describe the frequency of snoring in one night and in a week.
- The sound of snoring can reveal the site of airway obstruction. When the obstruction is nasal, the sound is usually high-pitched, like a whistle, and can be found during inspiration, during expiration or in both. If the obstruction is located in the nasopharynx or the oropharynx, adenoiditis and tonsillitis being the most frequent causes, you can identify the low-pitch snoring of a predominantly inspiratory pattern. On the other hand, if the obstruction is in the larynx, as in laryngomalacia, the stridor is also mainly inspiratory. In general, obstructions under the vocal folds do not generate symptoms only during sleep.
- Sometimes children sleep in unusual positions, with neck hyperextension or in semi-Fowler position, as if trying to improve the upper airways permeability.
- Obstructive apneas are present when you do not hear the respiratory flow in 2 or more respiratory cycles, but the thoracic breathing movements are not interrupted. When the apnea is too prolonged it is possible to notice a growing nasal flutter until the child reaches a more superficial sleep state, enough to start breathing through the mouth, ending the apnea episode.
- Other children change their position when they reach a deeper sleep state and the airways get obstructed. This triggers an evident fragmentation of the sleep continuum.
- Frequent waking-up associated with respiratory distress can be documented.
- Respiratory distress can be inferred by the presence of several signs:
 - 1) Increased effort to breathe, the snoring sound becomes characteristically rasping, even strangled, features that can only be properly described after listening to the recordings. In the case of obstruction due to adenoid or tonsil hypertrophy, this sound tends to be predominantly inspiratory.
 - 2) The duration of inspiratory and expiratory phases is usually similar, and it is rarely less than 3 seconds. In the obstruction caused by adenoid and tonsil hypertrophy, the inspiratory phase becomes more prolonged, and it is more noticeable than the expiratory.
 - 3) Costal and suprasternal retractions during inspiration are a clear sign of respiratory distress (paradoxical breathing). It is different from asthma, where retractions are associated with fast inspirations followed by prolonged expirations. In this case, we observe normal or prolonged inspirations and normal expirations.
 - 4) When there is a marked effort, one can notice an upward movement of the shoulders.

When finding clear signs of respiratory distress, associated with evident adenoid or tonsil hypertrophy, surgery is the option, and any another criteria of OSAS is unnecessary. On the other hand, to better understand the importance of the video

findings as indicators of respiratory obstruction, we can refer to the work of Dr. Silvan's group in Israel, data published in 1996.

This is a pioneer study, and it is highly possible that their conclusions will be modified with new similar studies being published. They correlated the findings of the 30-minute video with PSG in 58 children and used a table with a scoring system to evaluate the videos (**Table 1**). They found that scores equal to or higher than 10 were highly predictive of OSAS through PSG, and scores of 5 or less were associated with normal results. In this paper, the video sensitivity analysis was 94%, specificity 98% and predictability 84% when compared with PSG. 94%, specificity 98% and predictability 84% when compared with PSG.

Table 1. Scoring system to assess 30-minute videos

Inspiratory noise	Apneas
0. None	0. None
1. Mild	1. 1 or 2
2. Intense	2. ≥ 3
Type of inspiratory noise	Thoracic retractions
0. Episodic	0. None
1. Continuous	1. Intermittent
Movements during sleep	2. All the time
0. No movements	Mouth breathing
1. Few (≤ 3)	0. Never
2. Numerous (≥ 3)	1. Intermittent
Awakenings	2. All the time
1. Per each episode	

The assessment of videos recorded during sleep is only one tool among all the factors that have to be taken into consideration when making a decision on the procedures to follow when a child has airway obstruction. **Table 2** summarizes the main factors to take into account in a decision about when and which surgery must be performed.

Table 2. Factors and studies to consider for the indication of surgery in upper airway obstruction during sleep

<ul style="list-style-type: none"> ◆ Parents appraisal ◆ Possible consequences: <ul style="list-style-type: none"> - Growth delay - Behavioral disorders - Learning disorders - High blood pressure - Cor pulmonale: echocardiogram, hemoglobin, hematocrit ◆ Nocturnal asthma or hard-to-manage asthma ◆ Frequency of pharyngeal, naso-sinusal or otological infections 	<ul style="list-style-type: none"> ◆ Problems of speech hypernasality ◆ Facial growth alterations or dental malocclusion (by an orthodontist) ◆ Anatomical assessment of the airway: <ul style="list-style-type: none"> - Endoscopy - Convention radiology - CAT scanning - Magnetic Resonance Imaging (MRI) ◆ Assessment of video during sleep ◆ Nocturnal oxygen saturation monitoring ◆ Polysomnography ◆ Surgical risk
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The evaluation using home videos is very cost-efficient and can be extended as videotaping equipment becomes more readily available to the general population. An equipment-lending system or other mechanisms can also be organized. Given its low cost, it can be repeated several times if needed, whether there is a doubt or circumstances change. It allows you to make decisions by direct observation of the problem and can become an important tool in the decision about surgery. It can even be repeated to assess the surgical results. Its implementation should be included in the medical residency programs, because it is an excellent tool for training physicians to learn more about the clinical presentation of upper airway obstruction during sleep. It can be very useful in selecting cases that may need surgery, whenever access to PSG is limited.

Recommended readings

1. Farber JM. Clinical practice guideline: diagnosis and management of childhood obstructive sleep apnea syndrome. *Pediatrics*. 2002 Dec;110(6):1255-7; author reply 1255-7.
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5. Nixon GM. Brouillette RT. Diagnostic techniques for obstructive sleep apnoea: is polysomnography necessary? *Pediatric Respiratory Review* 2002;3, 18-24.
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