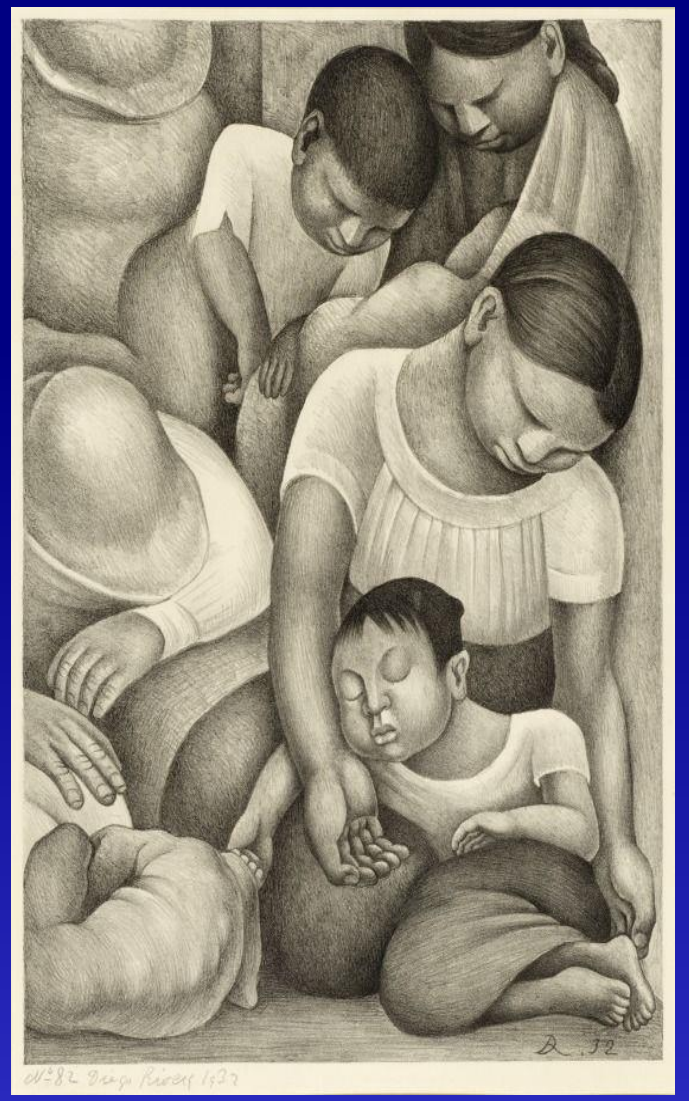
Sleep Apnea, New Treatments, Impact on Cognition and Long term health

Rafael Pelayo MD FAASM

Stanford MEDICINE

Sleep Is The Most Natural And Powerful Form Of Self-care For All Of Us



El Sueño Diego Rivera

Your life is reflected in your sleep

Your sleep is a reflection of your life

Functions of sleep

- Higher-order cognitive function involving mechanisms of learning and memory and synaptic plasticity

- Restorative function including maintenance of brain energy metabolism, macromolecular biosynthesis, and removal of metabolic waste

Sleep is a paradox

How do you feel when you are away and your cell phone is only half charged?

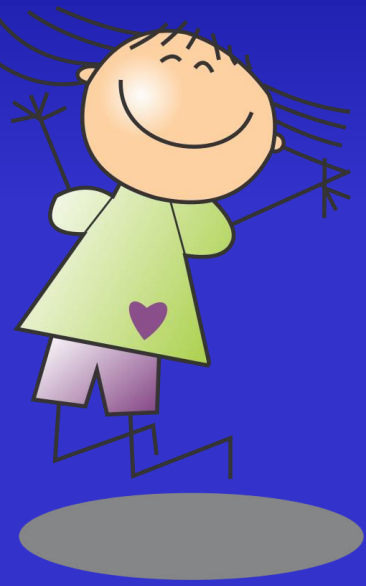
Sleep impacts behavior

Sleep disorders mimic attention and learning disorders

When one member of the family does not sleep it affects the entire family

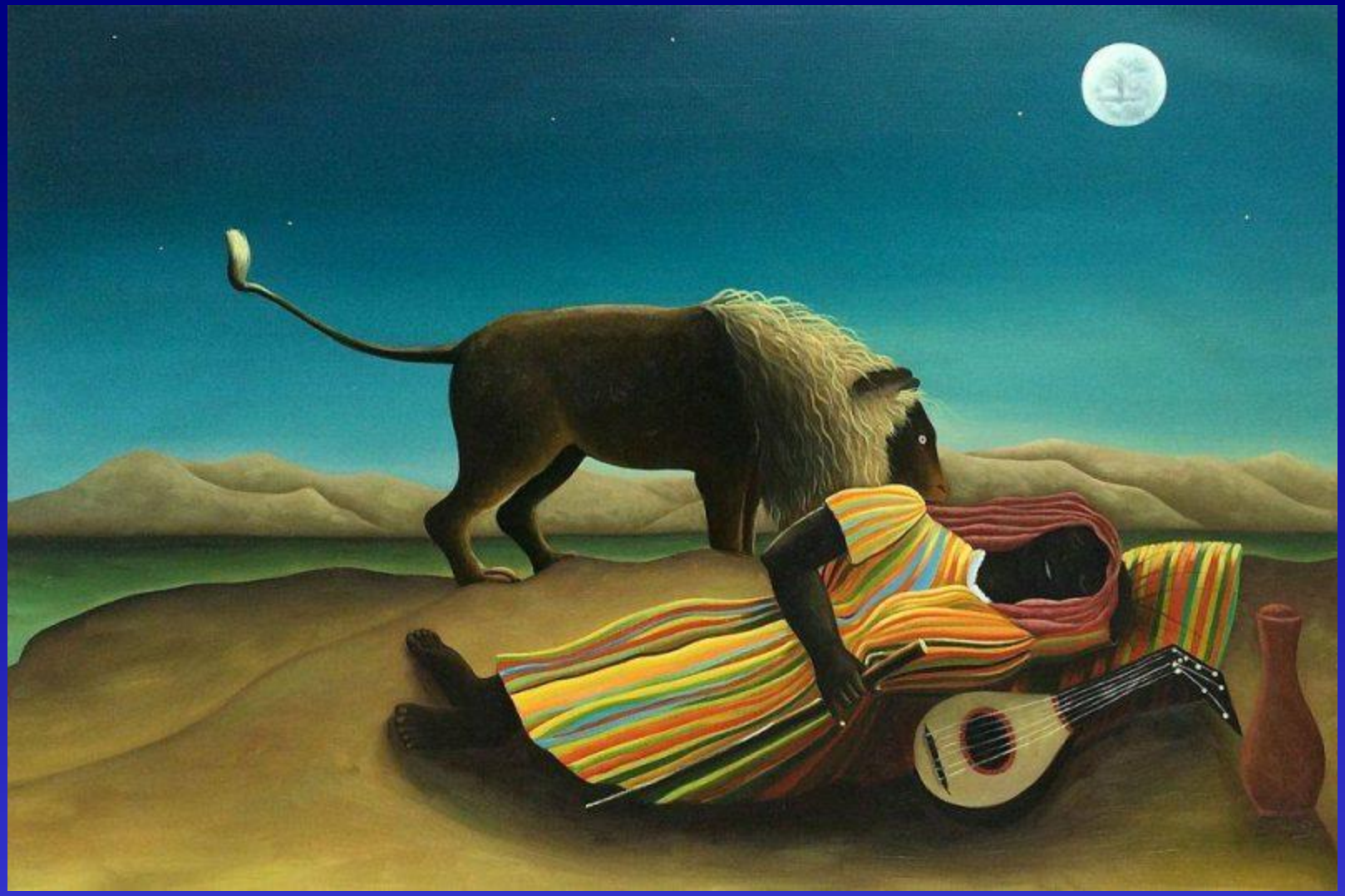
"If Mama ain't happy, ain't nobody happy"

The first thing that happens when you don't sleep well is you become irritable and inattentive



Remember being 7 or 8 years old and when you woke up realized you did not have to go to school?

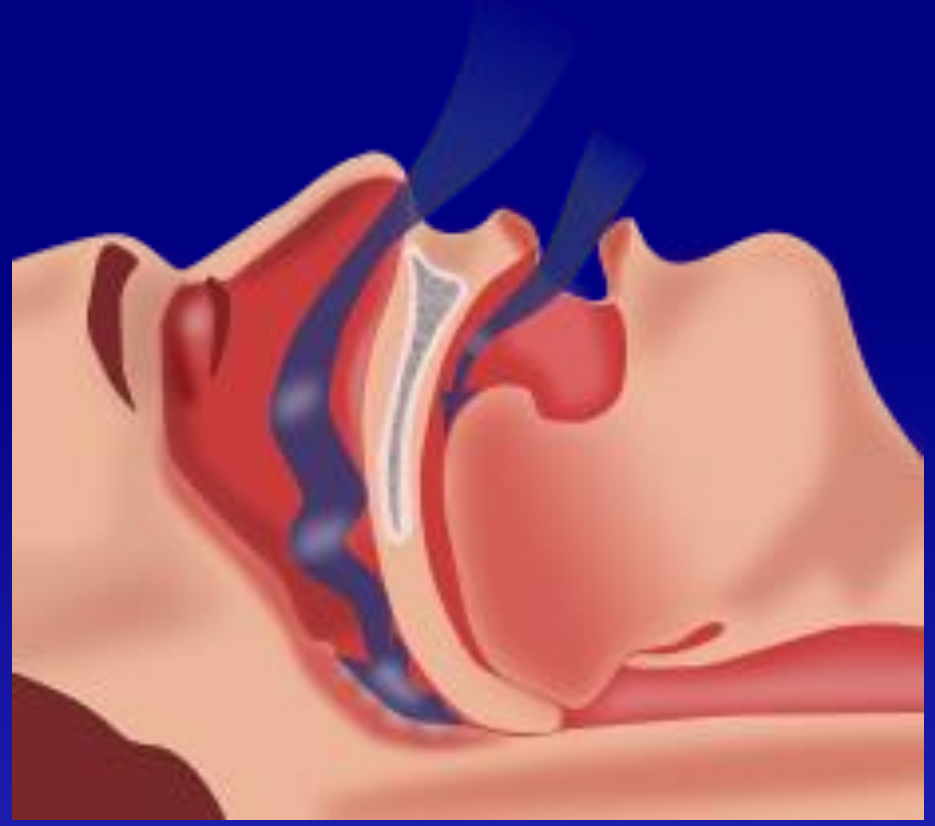
We sleep to help the brain learn



Sleeping should be silent

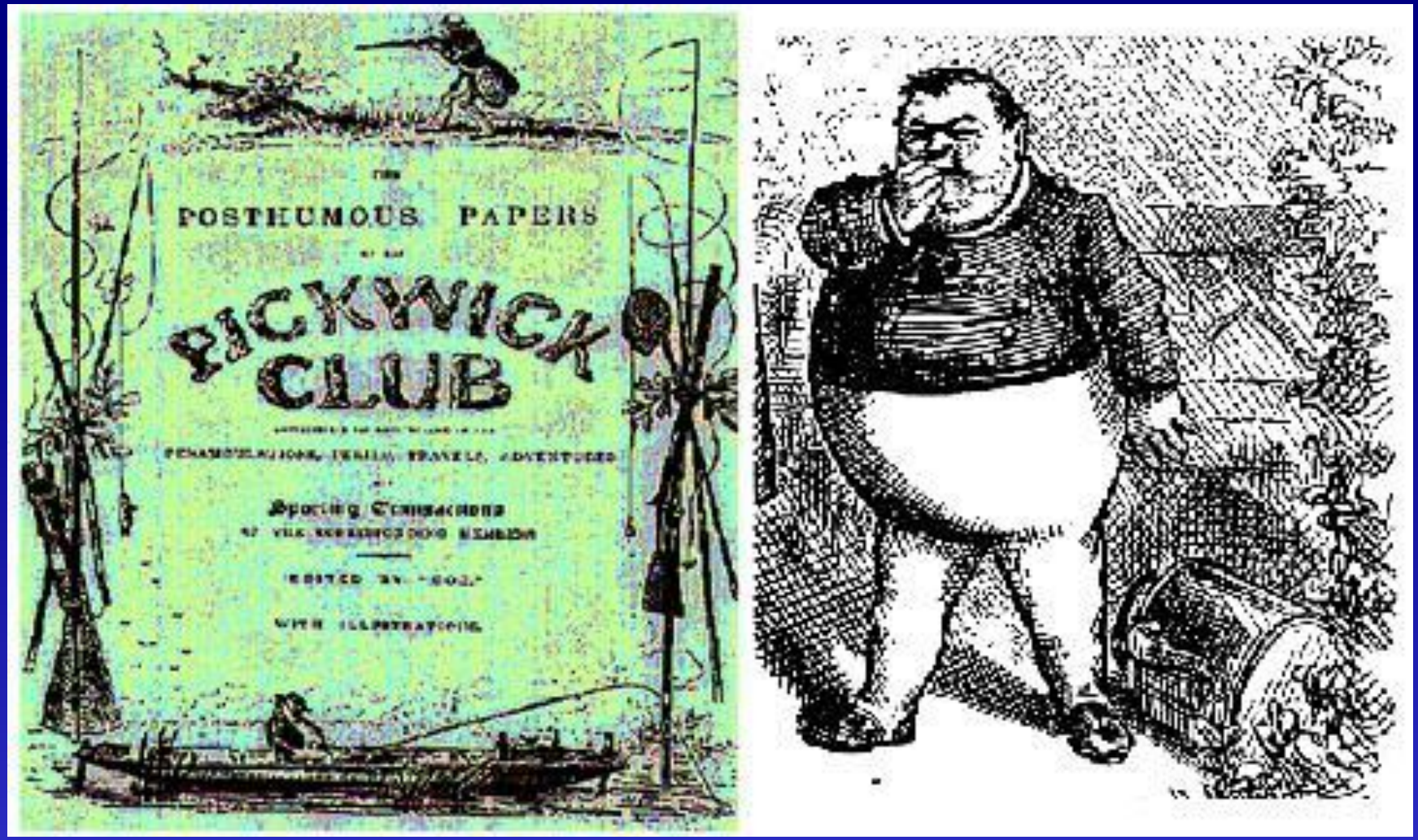
Obstructive Sleep Apnea

Intermittent pauses or difficulty breathing while sleeping due to a blockage in the throat



The brain prioritizes sleeping over breathing!

Pickwickian Syndrome



" Chronic enlargement of the tonsillar tissue is an affection of great importance, and may influence in an extraordinary way the mental and and bodily development of children... At night the child's sleep is greatly disturbed, the respirations are loud and snorting, and there is sometimes prolonged pauses, followed by deep, noisy inspiration. The child may wake up in a paroxysm of shortness of breath."

William Osler

The Principles and Practice of Medicine 1892

Mouth breathing means adenoids; adenoids mean deadened intellects

"Mouth breathing means adenoids; adenoids mean deadened intellects." In Gulick and Ayres, Medical inspection of schools, 1917 (2nd ed.), p. 4.

Typical adenoid faces showing mouth breathing, flattened noses, and protruding eyes

nyamcenterforhistory.org

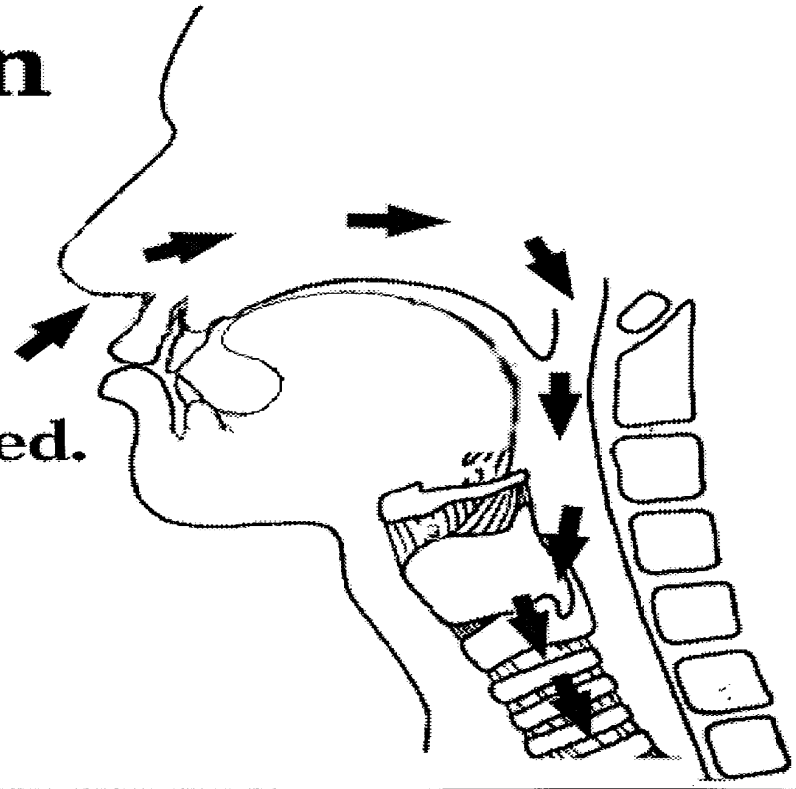
"Typical adenoid faces showing mouth breathing, flattened noses, and protruding eyes." In Gulick and Ayres, Medical inspection of schools, 1917 (2nd ed.), p. 170.

https://nyamcenterforhistory.org/2015/03/10/ adenoids-and-american-school-hygiene-in-the-early-20th-century/

Sleep Disorders in Children

Correct Physiological Rest Position

Anterior portion of tongue on palate.
Lips closed and relaxed.
Teeth apart.
Nasal breathing.

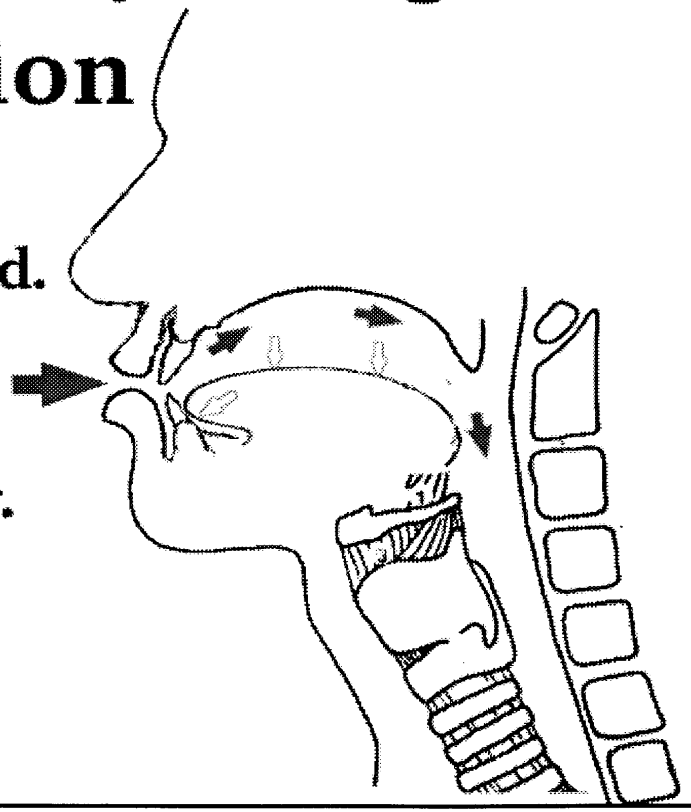


Naso-Respiratory Function and Cranialfacial Growth
James McNamara1979 as presented by James B. DuHammel DDS

Sleep Disorders in Children

Incorrect Physiological Rest Position

Tongue depressed.
Lips apart.
Teeth apart.
Mouth breathing.
Head forward.



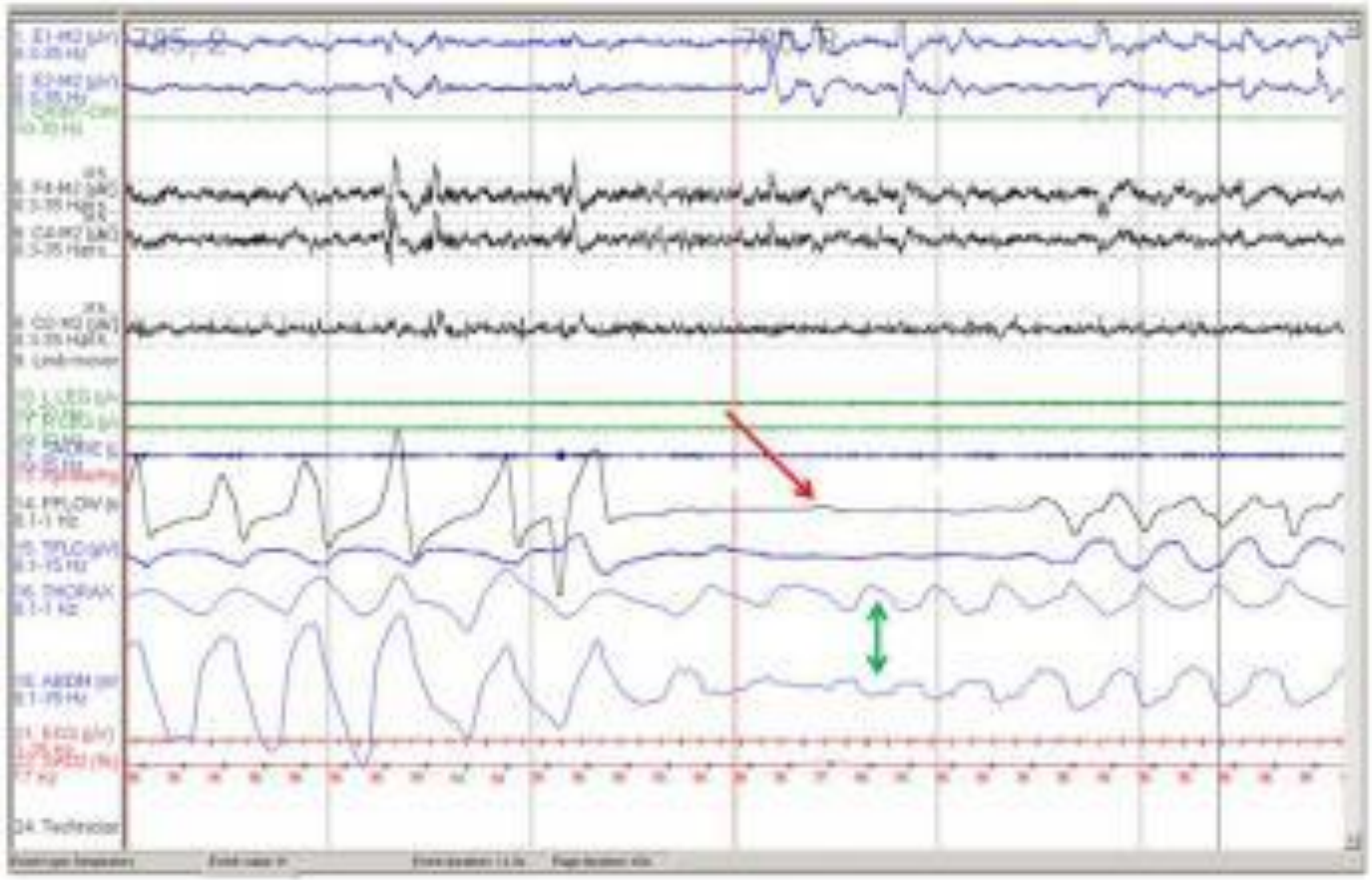
Naso-Respiratory Function and Cranialfacial Growth
James McNamara1979 as presented by James B. DuHammel DDS

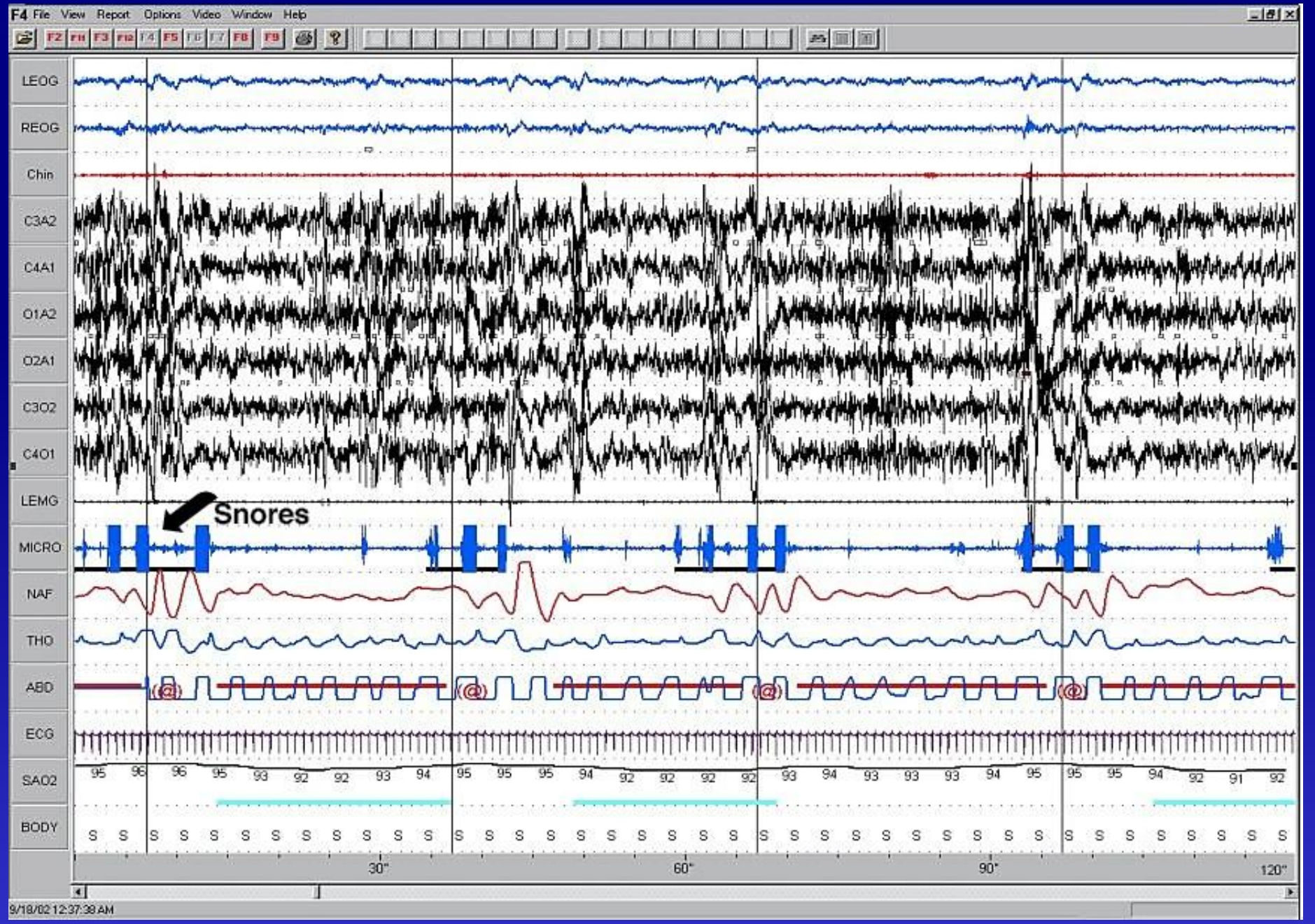
Attention-Deficit/Hyperactivity Disorder

" The essential feature of ADD/HD is a persistent pattern of inattention and/or hyperactivity-impulsivity that is more frequent and severe than is typically observed in individuals at a comparable level of development."

"There are no specific physical features...although minor physical anomalies (...**high arched palate...)** may occur at a higher rate..." DSM IV

Obstructive Sleep Apnea

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Obstructive Sleep Apnea

- Apnea is a pause in breathing, usually 10 seconds or longer
- Hypopnea is a decreased airflow or series of partial breaths that disrupt sleep or cause a decrease in oxygenation
- Sleeping is repetitively for brief time periods more important than breathing!

OSA Features

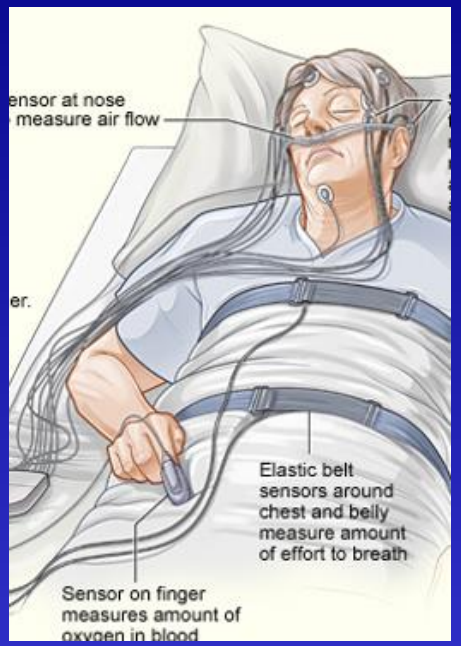
- Hypertension
- GI Reflux
- Morning headaches
- Unrefreshing sleep
- Behavioral awake problems
- Obesity (but thin people can have OSA too!)
- Excessive sleepiness
- Insomnia
- Bed wetting/ secondary nocturnal enuresis
- Night sweats
- Snoring/ Mouth breathing

Insurance companies require a sleep study to make a diagnosis and pay for treatment.

Polysomnograms in the sleep lab

V.

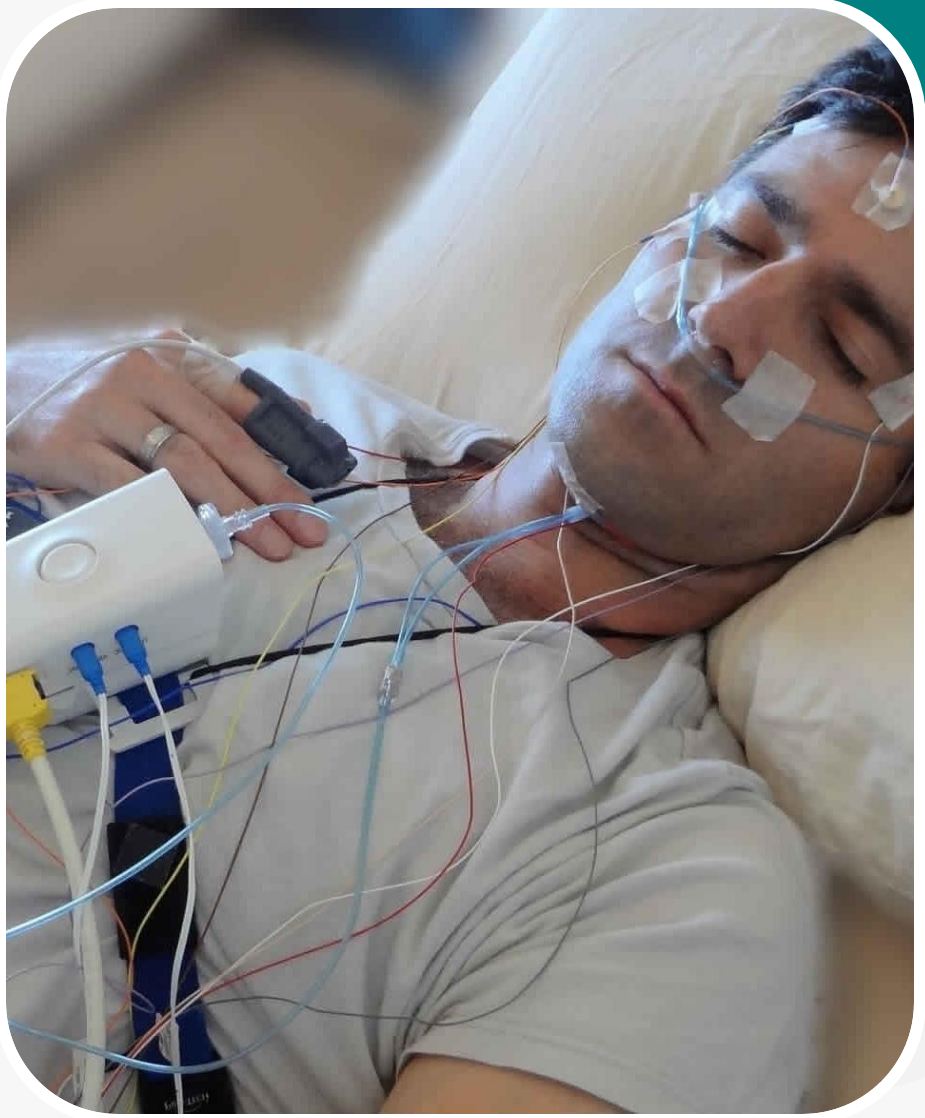
Home Sleep Study



What is Polysomnogram?

- Overnight monitoring of a patients sleep

- Simultaneous and continuous recording of several physiologic variables during sleep
- Hybrid term created at Stanford of both Latin and Greek roots consistent with our multidisciplinary culture and origins



How do we get a child to sleep in the lab?

How do you recognize a possible false negative PSG in a child?

Home Sleep (Apnea)
Testing - HST

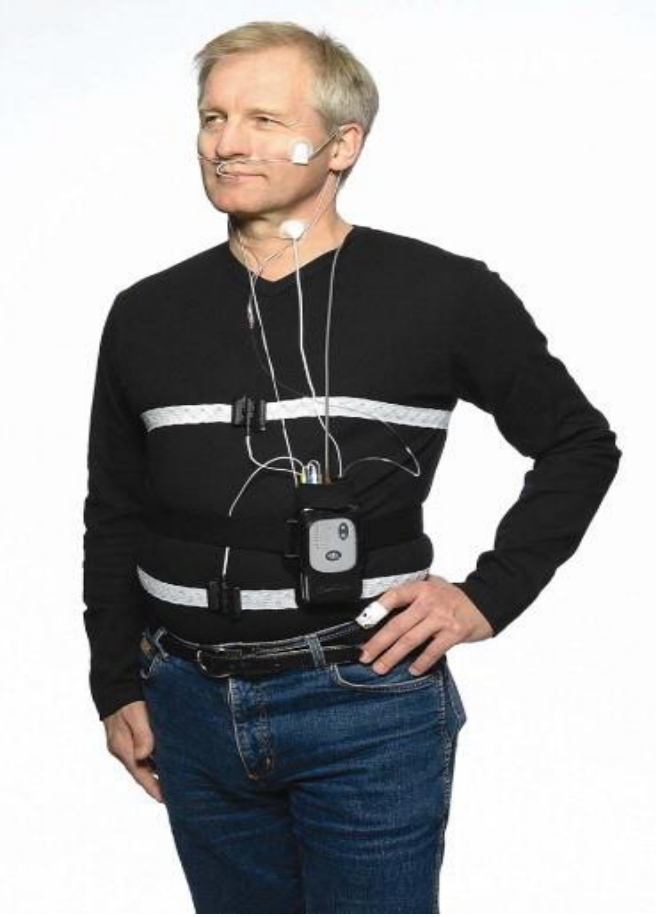
✓ Designed to evaluate breathing conditions

- Flow, effort (chest and abdomen), SaO_2, HR
- Some have position and snore channel

✓ A breathing test, that does not usually measure brain waves. True sleep not measured but rather inferred.

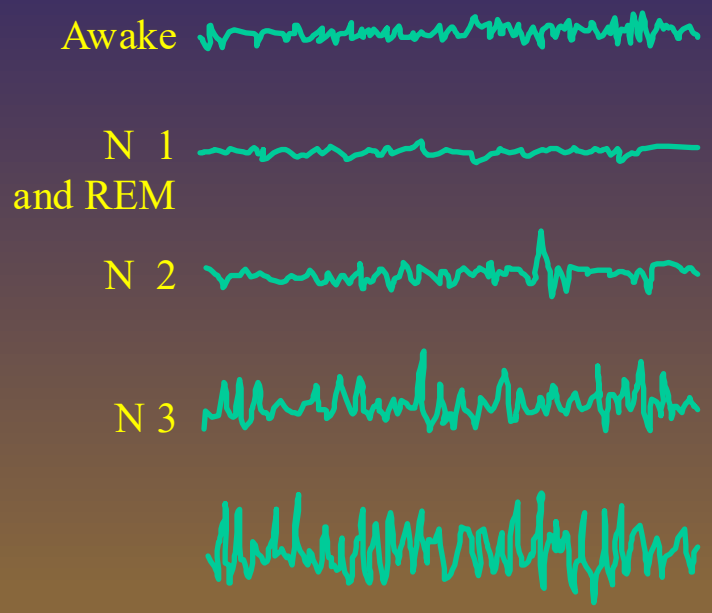
✓ In the USA HST not recommended by the American Academy of Sleep Medicine in children (yet)
✓ But Kaiser does them
✓ Prone to false negatives, especially in mild and thin patients

Type 3 HST and WatchPAT One

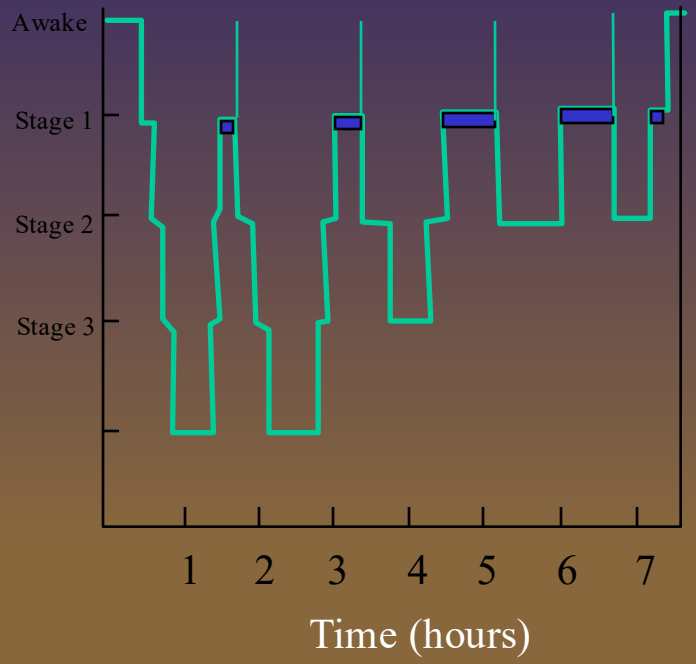


We are not merely sleep depriving children we are specifically dream depriving them

EEG Recordings



Typical Nighttime Sleep Pattern
in Young Adult



How common is OSA?

- Conservative estimated prevalence of OSA is approximately 3 to 7% for adult men and 2 to 5% for adult women in the general population, it may be as high as 26% of adults between the ages of 30 and 70 years
- Afflicts at least 25 million adults in the U.S, **1 billion world wide**
- In children estimated 1-5 %

Little coconuts do not fall far from the tree

Myth: Sleep apnea is so well treated in the Down syndrome community; it is no longer an issue

- Pt with DS are at an increased risk of developing OSA. Childhood prevalence around 50–100%, and near 100% in adulthood
- About half of these children presented with severe disease. Furthermore, even among those children with no history of snoring or witnessed apneas, the majority (53%) were found to have OSA on PSG and that traditional risk factors for OSA such as tonsil size or BMI were not predictive

Myth: I watch my child sleep and they don't snore so I know they don't have sleep apnea

High prevalence of OSA in individuals with DS likely reflects the presence of many risk factors contributing to airway obstruction. In addition to the common anatomic abnormalities often cited (macroglossia, adenotonsillar hypertrophy, midface hypoplasia), other associated conditions such as obesity, hypothyroidism, hypotonia, and gastroesophageal reflux are also encountered at significantly higher rates. As a result, a combination of mechanisms impacting breathing during sleep may need to be addressed.

Upper airway obstruction in children with Down syndrome

- 55 children at an academic tertiary care children's hospital underwent surgery
- surgical procedures including tonsillectomy, adenoidectomy, tonsillar pillar plication, uvulopalatopharyngoplasty, anterior tongue reduction, tonguehyoid suspension, laryngotracheoplasty, and tracheotomy
- 11 had significant residual symptoms after surgery
- **5 deaths occurred**

Jacobs IN; Gray RF; Todd NW: *Upper airway obstruction in children with Down syndrome* Arch Otolaryngol Head Neck Surg 1996;122:945-50

Early detection and treatment of obstructive sleep apnoea in infants with Down syndrome: a prospective, non-randomised, controlled, interventional study

The Lancet Regional Health – Europe 2024

- 40 infants with DS underwent PSG every 6 months in room air between 6 and 36 months of age (Screened Group) and were compared to a control group of 40 infants with DS receiving standard of care and a single, systematic PSG in room air at 36 months of age (Standard Care Group). When present, OSA was treated.
- The screened group had better development neurocognitive outcomes in the Screened Group compared with the Standard Care Group
- At 36 months AHI was higher in the Standard Group (4.0) compared to the Screened Group (1.0). Moderate and severe OSA more frequent in the Standard Group as compared to the Screened Group (18.9% v 3.7% for moderate and 27.0% v 7.4% for severe OSA)

Early diagnosis and treatment of OSA in infants with DS may contribute to a significantly better neurocognitive outcome and behaviour at the age of 36 months

Early detection and treatment of obstructive sleep apnoea in infants with Down syndrome: a prospective, non-randomised, controlled, interventional study

The Lancet Regional Health – Europe 2024

14/29 (48.3%) pts in the *Screened Group* underwent upper airway surgery before the 36-month PSG compared to 1/40 (2.5%) patient in the *Standard Care Group.* Median age at the time of surgery in the *Screened Group* was 16 mths. Only 1 patient in the *Standard Group* had a T&A at 26 months without a prior PSG

At the age of 6 months, 2.6% of the infants of the *Screened Group* had no OSA, and 43.6%, 20.5% and 33.3% had mild, moderate and severe OSA, respectively.

11/ 13 patients with severe OSA at 6 mths improved after surrgery and/or medical treatment (corticoids and/or anti-leukotrienes). 8 patients with moderate only one improved at 12 months without treatment. Two pts had severe persistent OSA during the entire study despite treatment with 1 pt requiring CPAP. Consequently, for the entire *Screened Group,* OSA improved between the age of 12 and 18 months, and plateaued between 18 and 36 mths.

Diagnosis and treatment of OSA in infants with DS may contribute to a significantly better neurocognitive outcome and behaviour at the age of 36 months

Computerized Positive Airway Pressure
Continuous Positive Airway Pressure

Not Just plain CPAP anymore

- Auto PAP
- Bilevel
- Bilevel with a backup rate
- Auto Bilevel
- ASV (adaptive servo ventilator)
- AVAPS (average volume assured pressure support)

CPAP miniaturized for travel

CPAP masks have gotten lighter and have more style and size options

ResMed

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Small. Light. Simple.

For many patients, their primary driver for mask choice is simple: less mask on their face. The minimalist category features masks that are small, lightweight and

Sleep in any position

This category features masks with a top-of-head connection, which keeps the system's tubing out of sight and out of the way. These masks help active sleepers

Patented memory foam offers unique comfort

Mask discomfort is the number one reason CPAP users fall off therapy (1), and the Ultra Soft category is designed to change that.

Classic designs that fit nearly every face

With a fit range of 97% for AirFit™ F20 (2) (3) (4) and 99% for AirFit N20 (5), you can always reach for these masks with confidence.

Freedom category

These masks feature top-of-head tube designs for more freedom at every turn

Full face mask

AirFit™ F30i

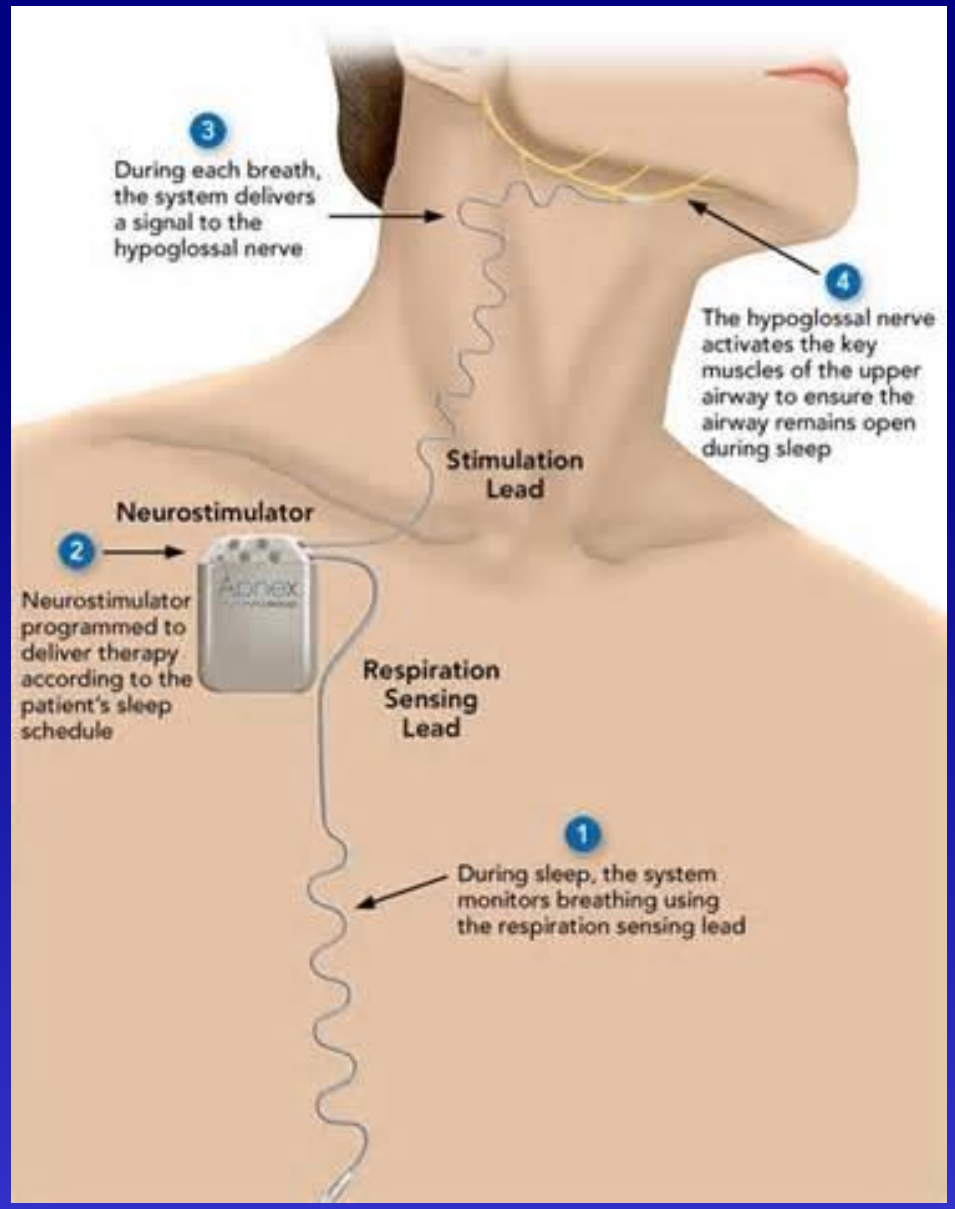
Nasal mask

AirFit™ N30i

Nasal pillows

AirFit™ P30i

Hypoglossal Nerve Stimulators



The effects of rapid maxillary expansion on persistent pediatric snoring post-tonsillectomy. Sleep Breath. 2022

- To investigate the short-term effects of rapid maxillary expansion (RME) on the quality of life of children who had persistent snoring post-adenotonsillectomy (AT).
- **Methods:** The study included children with maxillary constriction aged 5 to 12 years, two or more years after AT whose parents/guardians reported that they still snored ≥ 5 nights per week. We enrolled children with sleep-disordered breathing, including children with primary snoring and children with obstructive sleep apnea (OSA). All patients underwent laryngeal nasofibroscopy and complete polysomnography. Quality of Life (QOL) Questionnaire (OSA-18), the Pediatric Sleep Questionnaire (PSQ), Conners Abbreviated Scale (CAS), and the Epworth Sleepiness Scale (ESS) were administered before and after RME.
- **Results:** Of 24 children enrolled, 13 had primary snoring and 11 had OSA. Overall OSA-18 scores were reduced in both groups (intragroup difference, $p < 0.001$). The PSQ total score, CAS, and ESS were significantly reduced in both groups ($p < 0.001$) In the evaluation of snoring, there was a reduction due to the treatment effect in both groups ($p < 0.001$). Daytime sleepiness and attention deficit hyperactivity disorders were also positively affected in both groups.
- **Conclusions:** Our study demonstrated the potential benefit of RME in treating children with persistent snoring and transverse maxillary deficiency (TMD). RME can improve snoring and the QOL of children with refractory SDB after AT.

OXFORD Sleep Research Society®

SLEEP, 2023, XX, 1–11
https://doi.org/10.1093/sleep/zsad095
Advance access publication 4 April 2023
Perspective

Perspective

A roadmap of craniofacial growth modification for children with sleep-disordered breathing: a multidisciplinary proposal

Audrey Yoon[1,2,*], David Gozal[3], Clete Kushida[1], Rafael Pelayo[1], Stanley Liu[4], Jasmine Faldu[5] and Christine Hong[5]

Craniofacial modification by orthodontic techniques is increasingly incorporated into the multidisciplinary management of sleep-disordered breathing in children and adolescents…Orthodontists can guide craniofacial growth depending on age.

From infancy to adulthood the dentition and craniofacial complex change with growth patterns that can be intercepted and targeted at critical time points

The appropriate application of these orthodontic techniques will not only provide an important therapeutic option for children and adolescents with symptomatic sleep-disordered breathing but may help also mitigate or prevent its onset.

Hypoglossal nerve stimulation in adolescents with Down Syndrome and obstructive sleep apnea: A systematic review and meta-analysis *Front Neurol* ‘22

- 9 articles met the inclusion criteria. A total of 106 patients were included. All the studies showed that patients receiving hypoglossal nerve stimulation experienced a significant decrease in AHI of (at least 50%). The pooled AHI was significantly lower in patients following treatment (mean AHI reduction 17.43 events/h). Four investigations examined the necessity to optimize stimulation voltage for arousal during treatment. The most common complication was pain or discomfort in the tongue or mouth. Most studies had relatively short patient follow-up periods, with the most extended follow-up being 44–58 months.
- Hypoglossal nerve stimulation significantly reduces apnea-hypopnea index and improves the quality of life; and thus, could be a potential alternative therapy for obstructive sleep apnea in adolescents with Down syndrome. The adolescent's age, potential complications, adverse events, long-term efficacy, and comfort, needs to be considered while performing hypoglossal nerve stimulation

Prevalence of high-risk for obstructive sleep apnea in attention deficit hyperactivity disorder children referred to psychiatry clinic and impact on quality of life. Front Psychiatry. 2022

- To study the prevalence of high-risk obstructive sleep apnea (OSA) in attention deficit hyperactivity disorder (ADHD) children in a child and adolescent psychiatry clinic using the Thai version of the Pediatric Obstructive Sleep Apnea Screening Tool (POSAST) questionnaire. The secondary objective was to evaluate the quality of life and identify associated factors for high-risk OSA in ADHD children.
- **Study design:** Prospective cross-sectional study.
- **Material and method:** Caregivers of pediatric patients aged 5-18 years old and diagnosed with ADHD by child and adolescent psychiatrists were surveyed about their child's sleeping habits.
- **Results:** Two hundred and seventy-four subjects were included. The patients' mean age was 10.4 ± 2.6 years, and 82.8% were males. There were 30 children (10.9%) diagnosed with obesity, 46 (16.8%) with chronic rhinitis, and 9 (3.3%) with asthma. The median duration of ADHD symptoms was 22.1 months. The prevalence of high-risk OSA was 18.2% and was associated with significantly reduced quality of life (adjusted OR = 4.46, 95% CI: 2.26-8.81, $P < 0.001$). A significant association between high-risk OSA and obesity also emerged (adjusted OR = 2.84, 95% CI: 1.17-6.88, $P = 0.021$).
- **Conclusion:** An elevated prevalence of high-risk OSA is present among Thai children with ADHD, and significantly impacts quality of life. A significant association between high-risk OSA and obesity is also detected in patients with ADHD. Therefore, screening for high-risk OSA in ADHD patients may likely facilitate early detection and treatment of OSA, and potentially prevent adverse consequences.

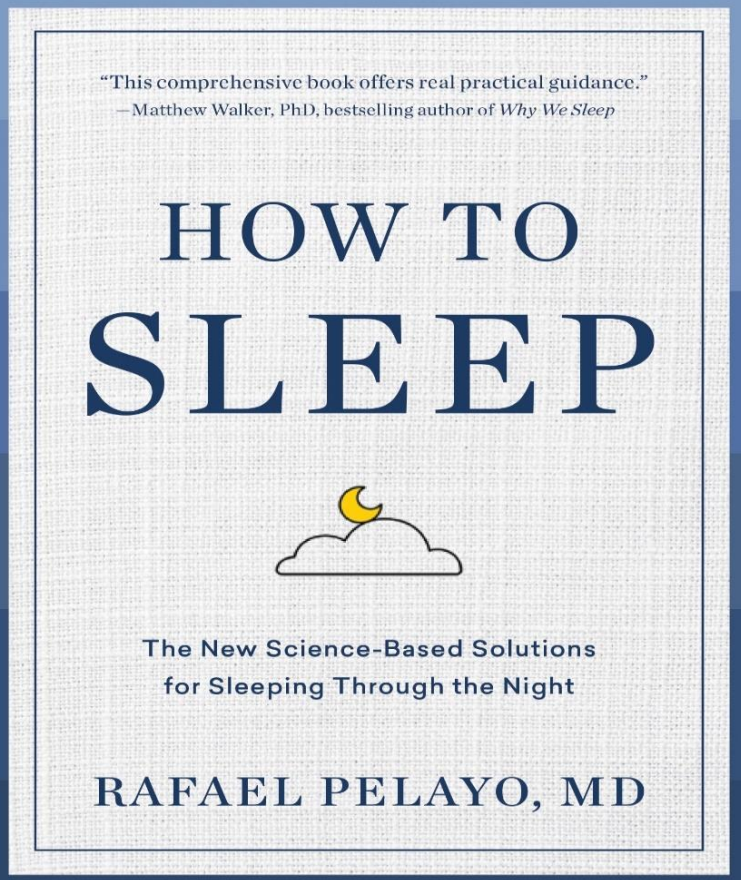
The Link between Pediatric OSA and Attention Deficit Hyperactivity Disorder (ADHD). *Children* (Basel). 2021

Review aims to summarize the research on the relationship between OSA and ADHD and investigate the impacts of OSA treatment on ADHD symptoms. A literature search was conducted on electronic databases with the key terms: "attention deficit hyperactivity disorder" or "ADHD", "obstructive sleep apnea" or "OSA", "sleep disordered breathing", and "pediatric" or "children". Review of relevant studies showed adenotonsillectomy to be effective in the short-term treatment of ADHD symptoms. The success of other treatment options, including continuous positive airway pressure (CPAP), in treating ADHD symptoms in pediatric OSA patients has not been adequately evaluated. Further studies are needed to evaluate the long-term benefits of surgical intervention, patient factors that may influence treatment success, and the potential benefits of other OSA treatment methods for pediatric ADHD patients.

Sleep and Fully Recharge Your Brain!

Resources

- Start School Later www.startschoollater.net
- National Sleep Foundation thensf.org
- American Academy of Sleep Medicine sleepeducation.org
- California Sleep Society



Questions?