It’s Good To Breathe Well at Any Age, All the Time

OSA

**Adult**
- Mild: AHI 5 - 15
- Moderate: 15 - 30
- Severe: > 30

**Pediatric**
- Yes
- No

Pediatric Obstructed Airway

**Differs from Adult SDB**

**Signs and Symptoms**
- Snoring
- Gasping, Choking
- Excessive Daytime Sleepiness

**Pathogenesis**

**Diagnosis**

**Treatment**

**Outcomes**

**Adult OSA Treatment Goals**

**Address Chief Complaint**
- Snoring
- Gasping, Choking
- Excessive Daytime Sleepiness

**Manage Chronic Disease**
- HTN, Mood, Diabetes, CV Risk
Pediatric Obstructed Airway Treatment Goals

Pediatric Obstructed Airway

Today

- Signs and Symptoms
- Pathogenesis
- Diagnosis
- Treatment

Finding Adult Patients at Risk

Children are Not Just Little Adults

OSLER’S DISCOVERY (1892)

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 inspirations. The child may wake up in a paroxysm of shortness of breath. In long standing cases the child is very stupid looking, responds slowly to questions, and may be sullen and cross.
How Many Children?
7 of 10 children under 10 sleep poorly

1 in 20 – 100 children will have Obstructive Sleep Apnea

Observer Reports
The distinctive symptoms of OSA in children are remarkably scarce and usually require a high level of suspicion or alternatively, require systematic implementation of explorative screening questions to enable their detection.

Observer Reports
high level of suspicion
Even children with risk factors and diagnosable disease have long periods of normal sleep.

Parent Observation

<table>
<thead>
<tr>
<th></th>
<th>+</th>
<th>-</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PARENT</strong></td>
<td>31</td>
<td>69</td>
</tr>
<tr>
<td><strong>SLEEP STUDY</strong></td>
<td>57</td>
<td>43</td>
</tr>
<tr>
<td><strong>DIFF</strong></td>
<td>-26%</td>
<td>+25%</td>
</tr>
</tbody>
</table>

Nasal Breathing, 24/7, eliminating oral breathing, is the only valid ‘Finish Line’ in treatment of pediatric SDB.

Finding Connor Deegan

“Finding Connor Deegan.”

– Valerie Deegan
Behavior Observation - Mouthbreathing

BEARS Questionnaire

Bedtime  child have trouble going to bed or falling asleep?
Excessive Daytime Sleepiness  child sleepy or groggy? Tired, moody, ‘out-of-it’?
Awakening During the Night  with trouble going back to sleep?
Regularity + Duration of Sleep  How many hours? Is this Enough?
Snoring  Does my child make any sleep sounds?

I’m Sleepy

Pediatric OSA Screener

Poor Growth
Fussiness
Inconsolability

Is child Irritated or angry?
Body Mass Index above average?

Does child Snore?
Does child have Labored breathing while sleeping?
Ever notice a stop in child’s breathing during sleep?

Does child have Enlarged tonsils and/or adenoids?
Does child have Problems with concentration?

Does child Yawn or is tired/sleepy during the day?
Behavioral Clues

- Poor Learning
- Daydreaming
- Inattention/Hyperactivity

Behavioral Clues

- Sleepy in Class
- Affective Disorders

Chronic Poor Sleep

daytime tiredness
difficulties with focused attention
low negative emotion threshold irritability
easy frustration
difficulty modulating impulses

ADHD  SDB
ADHD

Hyperactive – Impulsive
Fidgety
Constant Talking, Constant Motion
Impatient
Unrestrained Emotions

ADHD

Inattentive
Easily Distracted
Bored
Daydreaming
Difficulty Completing Tasks
Can’t Focus

ADHD and SDB

1113 Children with Both ADHD and SDB
1405 Controls

“medium relationship between ADHD symptoms and SDB”

Attention Deficit Hyperactivity Disorder And Sleep Disordered Breathing In Pediatric Populations: A Meta-analysis.
Sleep Med Rev. 2013 Dec 24
ADHD and SDB

Patients with ADHD symptomatology should receive SDB screening.

Treatment of comorbid SDB should be considered before medicating the ADHD symptoms if present.

SDB and Depression

“Depressive symptoms are higher in SDB children.

Treating SDB might reduce pharmacotherapy, improve sleep patterns, and promote health”

ADHD Treatment

Airway Collapse at Any Age

Response to Pressure Change in a Flexible Airway
Airway in Children

It’s Still a Pressure Change in a Flexible Airway

Variables:
- Resting Muscle Tone
- Dynamic Response to Pressure Changes
- Airway Anatomy
- Obesity

The Most Common Etiology
But It’s Not Just Soft Tissue

Scaffold for the Upper arch

Arch With No Scaffold

Arch With a Proper Scaffold

March 2, 2019

Barry Raphael DDS

Steve Carstensen DDS
SeattleSleepEducation.com
Tongue Not In the Palate

What Can Dentists Do?

Identify the problem early

6

birth

post puberty

Growth Episodes

Tongue

Muscular Hydrostat

Muscular Structures Without Bones

Connective Tissue Keeps Volume Constant During Muscle Contractions

Bone vs. Muscle

Correct Tongue position and Swallowing

EFFECTS of MOUTH BREATHING
Prevalence of Crossbite and Class 2 Patients

90 children 5 - 10 yrs age with SDB risk
Assessed by Otolaryngologist and Orthodontist

15% posterior cross bite  4.8% overjet >7mm

Don’t think all SDB kids have skeletal malocclusion

Does 4-Bicuspid Extraction Cause OSA?

The absence of four premolars (one from each quadrant), and therefore a presumed indicator of past "extraction orthodontic treatment," is not supported as a significant factor in the cause of OSA.

Wrong Question.

★ 2 years old 55% developed
★ 4 years old 73.33% (male) 77.68% (female)
★ 12 years old 89.43% (male) 94.36% (female)

Right Question

What Can I Do Now to Grow Enough Bone for Airway AND Teeth?

Maxillary Bone Growth

Sutural Growth continues to age 10

Intramembranous Ossification

Enlargement of the Maxillary Sinus

Alveolar Process Development

Development and Growth of the Maxilla Dr. Heba Mahmoud Elsabaa. Oral Biology text 2012
Mandibular Bone Growth

Meckle’s Cartilage

Growth centers near condyle, lingual foramen and mandibular symphysis

Intramembranous and Chondroid growth also

Birth - 4 Years

4 - 6 Years

Overjet

Before

After

4 - 6 Years

Growth of the mandible and biological characteristics of the mandibular condylar cartilage


March 2, 2019
Cephalometric Norms

Do not reflect Growth Potential

Why Be Concerned with Childhood OSA?

Clinical Consequences
- ADHD
- Pulmonary Hypertension
- Cardiomegaly
- Failure to Thrive and Growth Retardation
- Heavy Use of Healthcare / Higher Morbidity

Cardiovascular
- Elevated Arterial Pressure
- Pulmonary Hypertension
- Cardiomegaly
- Endothelial Dysfunction

Metabolic Disorders
- Obesity and Breathing-Disrupted Sleep interact to increase the severity and morbid consequences of each other
Cognitive and Behavioral

- Intelligence
- Memory
- Executive Function
- Academic Performance

Hyperactivity
Agression
Inattentive Behaviors

Be A Good Doctor

If the Signs and Symptoms Can’t Be Explained by the Anatomy, Keep Looking and Refer

- Congenital Craniofacial Anomalies
- Genetic Syndromes
- Neuromuscular Disorders
- Allergies
- Asthma
- GERD

“The Evidence linking sleep pathology to symptoms of hyperactivity, inattention, and other neurobehavioral deficits is robust and convincing yet replete with contradictions.”

Dillon, J, Chervin, R Principles and Practices of Pediatric Sleep Medicine

Seldom is there so much agreement on the scope and significance of a problem with so little consensus on its meaning and mechanism”

Dillon, J, Chervin, R Principles and Practices of Pediatric Sleep Medicine
Treatment of SDB in Children

Risk Factors for Childhood OSAS

No. 1 Risk Factor: Adenotonsillar Hypertrophy
No. 2 Risk Factor: Adenotonsillar Hypertrophy
No. 3 Risk Factor: Adenotonsillar Hypertrophy

Then comes everything else

so says Carol Rosen, MD

Treatment of Pediatric SDB

Role of Adenotonsillectomy in the Management of Pediatric Obstructive Sleep Apnea: Findings from the Childhood Adenotonsillectomy (CHAT) Study


Primary Outcomes: Cognitive and Executive Functions
Secondary Outcomes: PSG, behavior, OSAS Symptoms, QOL

397 Children ages 5 – 9
   Early AT surgery (n = 194)
   Watchful Waiting (n = 203)
Children ages 5 – 9
AHI > 2
Tonsillar hypertrophy
No ADHD Meds
Mostly Healthy except for tonsillitis
No severe hypoxia

453 children began the study
397 children completed
Early AT surgery (n = 194)
Watchful Waiting (n = 203)

17 serious adverse events
7 in early AT
9 in WW
1 before they started

Primary Outcomes:
Attention / Executive Function
Not Improved

Secondary Outcomes:
Behavior
QOL
PSG Results - AHI/O2
Improved

What about AHI?

Normalized AHI %

WW  eAT

…at 7 months

March 2, 2019
What about the other 20%?

What about after 7 months?

High Level of Suspicion
Muscle Tone Differs in POSAS
Obesity Affects Residual Apnea
Growth and Development Issues
Neurological Injury / Deficit

Must Stay Observant!

PAP Efficacy
No RCTs
Observational studies show improvement in 85% of children

PAP Adherence

56 Children in a study

Mean Use: 2.8 hours per night, +/- 2.7 hours

Maternal Education was greatest predictor


PAP for Kids

How Many Hours of Therapy Needed is Unknown

Lots of Side Effects

Oxygen supplement by itself is ineffective, except in some infants

Nothing’s Free

Midface Hypoplasia

PAP complication for kids

More severe < 3 years

Total Face mask works Better

Excellent Summary of Assessing Children’s Sleep

Sleep Prosthodontics: A New Vision for Dentistry
Jeffrey S. Rouse, DDS

inside dentistry | July 2013 | www.insidedentistry.net
The American Association of Orthodontists (AAO) recommends that all children get a check-up with an orthodontist at the first recognition of the existence of an orthodontic problem, but no later than age 7. Few patients will need to begin treatment that young, but there are some who will benefit from early intervention. For these patients, treatment is likely to consist of guiding the growth of the jaws so that the permanent teeth are in good positions as they come in.
Resources for Growth and Development

LearnAirwayOrtho.com

Diagnosis Begins With Observation

Limitations of PSG for Children

Sensor Size

Facility Access

Technologists trained for adults
HST for Children

Limitations of HST for Children

Sensor Size

Adult failure rate 25%

Algorithms designed for adults

American Academy of Sleep Medicine Position Paper for the Use of a Home SAT for the Diagnosis of OSA in Children

Use of a home sleep apnea test is not recommended for the diagnosis of obstructive sleep apnea in children. The ultimate judgment regarding propriety of any specific care must be made by the clinician, in light of the individual circumstances presented by the patient, available diagnostic tools, accessible treatment options, and resources.

Oximetry as P-OSA Screener

50 children with PSG studies

Home Sleep Recorders

Oximetry Studied Separately


March 2, 2019
Oximetry as P-OSA Screener

ODI3 - number of desats 3% below mean
100hz sampling

With Cutoff of 1 event/hr, 85.5% accuracy with Oximetry

Sleep Quality Assessment

Two Big Benefits
Not a Sleep Apnea Test
FDA Clearance for Sleep Quality

FDA Clearance for Sleep Quality
New Conversations
Non Threatening to MDs
ANS and Sleep

The variables:
- Heart Rate
- Breathing Rate and Depth
- Blood Pressure

NREM

<table>
<thead>
<tr>
<th>Stable</th>
<th>Unstable</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Frequency Coupling (HFC)</td>
<td>Low Frequency Coupling (LFC)</td>
</tr>
<tr>
<td>Heart Rate</td>
<td>Steady</td>
</tr>
<tr>
<td>Breathing Rate and Depth</td>
<td>Steady</td>
</tr>
<tr>
<td>Blood Pressure</td>
<td>Dips</td>
</tr>
</tbody>
</table>

Adrenergic Hormones

<table>
<thead>
<tr>
<th>Stable</th>
<th>Unstable</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Frequency Coupling (HFC)</td>
<td>Parasymпатетic Dominant</td>
</tr>
<tr>
<td>Low Frequency Coupling (LFC)</td>
<td>Sleep</td>
</tr>
<tr>
<td>Stable</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Stable Sleep</td>
</tr>
</tbody>
</table>
High Frequency Coupling (HFC)

Low Frequency Coupling (LFC)

Limitations of Diagnosis

131 Board Certified Sleep Docs
Pediatric Training

“...patients with a craniofacial morphology consistent with pediatric OSAS (retrusive chin, steep mandibular plane, vertical direction of growth and a tendency toward Class II malocclusion) ...

When accompanied by a history of snoring, inability to breathe through the nose, significant allergies, asthma or obesity,

the dentist should refer the patient to an otolaryngologist for assessment.”

How do Academies interpret evidence?

American Academy of Pediatrics  
American Academy of Pediatric Dentistry  
American Academy of Sleep Medicine  
American Academy of Otolaryngology-Head & Neck Surgeons (AAOHNs)

Study first. Cut Later.

Cut! Cut! Cut!
 Observer Reports

The distinctive symptoms of OSA in children are remarkably scarce and usually require a high level of suspicion or alternatively, require systematic implementation of explorative screening questions to enable their detection.

Obstructive Sleep Apnea In Children: A Critical Update
Hui-Leng Tan, David Gozal, and Leila Kheirandish-Gozal

Mamas,

Don’t Let Your Babies Grow Up to Be Snorers!

high level of suspicion