Disclosures

Director of Sleep Education for Airway Technologies
Have Lectured for Various Companies

Director of Sleep Education for Pankey Institute

Guest Lecturer at Spear Education, University of the Pacific and
Louisiana State Dental School

Advisor, SleepArchITx, BEDDR Sleep, Glidewell Dental Lab
Co Author, The Clinician's Handbook for Dental Sleep Medicine

OSA

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

**Pediatric**
- Yes
- No

**OSA**

**Pediatric**
- Mild: AHI 0 -1
- Moderate: 5 - 10
- Severe: > 10

Includes CO2 measurements
Events last ‘2 breaths’
Pediatric Obstructed Airway

Differs from Adult SDB

Signs and Symptoms
Pathogenesis
Diagnosis
Treatment

Outcomes

Literature

Support

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

Is it a Sleeping Problem?
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.

Even children with risk factors and diagnosable disease have long periods of normal sleep.

Observer Reports

high level of suspicion

Obstructive Sleep Apnea In Children: A Critical Update

Hui-Leng Tan, David Gozal, and Leila Kheirandish-Gozal


Pediatric Obstructive Sleep Apnea Syndrome

Eliot S. Katz, MD, Carolyn M. D’Ambrosio, MD
Nasal Breathing, 24/7, eliminating oral breathing, is the only valid ‘Finish Line’ in treatment of pediatric SDB

Finding Connor Deegan

“Finding Connor Deegan.”
—Vivere 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?
Any stopping, choking, or gasping?
I’m Sleepy
Pediatric OSA Screener

Pediatric Sleep Questionnaire

“We conclude that the SRBD, snoring, sleepiness, and behavioral scales are valid and reliable instruments”

23 questions for parents/caregivers

WHILE SLEEPING, DOES YOUR CHILD:

Snore more than half the time? ……………………………………………………… Y N DK
Always snore? ………………………………………………………………………….. Y N DK
Snore loudly? …………………………………………………………………………… Y N DK
Have “heavy” or loud breathing? ……………………………………………………. Y N DK
Have trouble breathing, or struggle to breathe? ………………………………. Y N DK

Behavioral Clues

- Poor Growth
- Fussiness
- Inconsolability

Behavioral Clues

- Poor Learning
- Daydreaming
- Inattention/Hyperactivity

Steve Carstensen DDS
North Dakota Dental Association
September 2020
**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

*Seminars in Pediatric Neurology, Mar 1996.*

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**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 and SDB

SDB and Depression

The Relationship Between Depressive Symptoms And Obstructive Sleep Apnea In Pediatric Populations: A Meta-analysis.

J Clin Sleep Med, 2013 Nov 15

SeattleSleepEducation.com SeattleSleepEd@gmail.com
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
Charlotte, 6

But It’s Not Just Soft Tissue

Airway and TMJ
Arch With No Scaffold

Arch With a Proper Scaffold

Scaffold for the Upper arch

Tongue Not In the Palate

What Can Dentists Do?

Identify the problem early

birth

post puberty

Growth Episodes
Tongue

Muscular Hydrostat

Muscular Structures Without Bones

Connective Tissue Keeps Volume Constant During Muscle Contractions

- Limited or No Breastfeeding
- Weak Tongue & Orofacial Muscles
- Soft Diet / Processed Foods
- Poor Oral Habits (thumb / finger / to sucking pacifiers, tongue/blade, etc.)

Normal Craniofacial Growth

- 2 Years Old 55% developed
- 4 years old 73.33% (male) 77.68% (female)
- 12 years old 89.43% (male) 94.36% (female)
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 study compared 5584 adults age 40 - 70

Major Assumption: Presence of health insurance means the subjects at risk had been OSA tested

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.


SeattleSleepEducation.com  SeattleSleepEd@gmail.com
Does 4-Bicuspid Extraction Cause 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?

The Cranio-Facial-Respiratory Complex (CFRC)

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

Cephalometric Norms

Do not reflect Growth Potential

Problem:
Metrics for Identifying Poor Development with an Airway Focus have Not been Set

Childhood Sleep-Disorder Breathing: A Dental Perspective
Kevin L. Boyd and Stephen H. Sheldon

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 | Hyperactivity |
| Memory | Agression |
| Executive Function | 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

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 %

...at 7 months
What about the other 20%?

What about after 7 months?

Health Care Costs

<table>
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<th>2 years</th>
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<tbody>
<tr>
<td>AT surgery</td>
<td></td>
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<tr>
<td>4276 children</td>
<td></td>
</tr>
<tr>
<td>2 - 16 years</td>
<td></td>
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<tr>
<td>AT hypertrophy</td>
<td></td>
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<tr>
<td>Median Costs</td>
<td></td>
</tr>
<tr>
<td>37%</td>
<td></td>
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<tr>
<td>Ab Costs 66%</td>
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<tr>
<td>OV Costs 32%</td>
<td></td>
</tr>
</tbody>
</table>

Cost Analysis of Tonsillectomy in Children Using Medicaid Data

Chang, Jen Jen et al. The Journal of Pediatrics, Volume 164, Issue 6, 1346 - 1351.e1

High Level of Suspicion

Muscle Tone Differs in POSAS

Obesity Affects Residual Apnea

Growth and Development Issues

Neurological Injury / Deficit

Must Stay Observant!

CPAP?
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

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September 2020

SeattleSleepEducation.com
SeattleSleepEd@gmail.com
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

Treatment of SDB in Children

video courtesy of The Healthy Start

Early Intervention

video courtesy of The Healthy Start

Orthodontists

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.
Orthodontists

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AAO White Paper February 2019

Orthodontists should be familiar with the signs and symptoms of OSA in pediatric patients. In the growing child, OSA management is dramatically different than for the adult. Dentofacial orthopedic management also may be considered. The Orthodontist has expertise in diagnosing skeletal growth patterns. Regardless of the presence of OSA, it is recommended the orthodontist use these devices when there is an underlying skeletal issue.

AAO White Paper February 2019

All orthodontists should consider incorporating OSA screening into their history-taking and examination of patients.

The Problem:
Lack of research specifically addressing how addressing the skeletal issues affect airway, the risk for developing OSA, and the long term health of the person.

Resources for Education

LearnAirwayOrtho.com
myobrace
ASAP Pathway
Face Focused Orthodontics

SeattleSleepEducation.com  SeattleSleepEd@gmail.com
Diagnosis Begins With Observation

Limitations of PSG for Children

- Sensor Size
- Facility Access
- Technologists trained for adults

PSG for Children

HST for Children

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September 2020

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## Limitations of HST for Children

### Sensor Size

**Adult failure rate 25%**

**Algorithms designed for adults**

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## 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.


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## Oximetry as P-OSA Screener

**50 children with PSG studies**

**Home Sleep Recorders**

**Oximetry Studied Separately**

**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></th>
<th>Stable</th>
<th>Unstable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart Rate</td>
<td>Steady</td>
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</tr>
<tr>
<td>Blood Pressure</td>
<td>Dips</td>
<td>Steady</td>
</tr>
</tbody>
</table>

#### Adrenergic Hormones

- **Unstable**
  - High Frequency Coupling (HFC)
  - Low Frequency Coupling (LFC)

- **Stable**
  - High Frequency Coupling (HFC)
  - Low Frequency Coupling (LFC)

- **Unstable**
  - Adrenergic Hormones
  - Low Frequency Coupling (LFC)

#### Parasympathetic

- **Stable**
  - Sympathetic
  - Dominant
  - Sleep
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.”

Craniofacial Morphological Characteristics
In Children With Obstructive Sleep Apnea Syndrome
A systematic review and meta-analysis
JADA 144(3) March 2013

How do Academies interpret evidence?

American Academy of Pediatrics
American Academy of Pediatric Dentistry
American Academy of Sleep Medicine

Study first.
Cut Later.

American Academy of
Otolaryngology-Head & Neck
Surgeons (AAOHNs)

Cut! Cut! Cut!

Effective Children’s Airway Systems
Not Doctor-Driven
Support Materials
Dedicated Space
Why a Dedicated Space?

Parasympathetic

Sympathetic

Don’t Forget the Dopamine!

pSRBD

End Stage Disease

Chronic Non-Infective Disease

OSAS

Condition of Growth

Prevention Works

Treat in Stages

Evaluation and Consultation

Records and Imaging

Increasing Age

Habit Correcting

Guided Growth

Orthodontics

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North Dakota Dental Association

September 2020

SeattleSleepEducation.com

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Pankey Cross of Dentistry

Know Your Patient
Know Yourself
Know Your Work
Apply Your Knowledge

Pankey Cross of Management

Operations
Staff Development
Market Development
Financial

PRACTICE HEALTH

REWARD

Adding Children’s Airway Services is Totally Aligned with Dr. Pankey’s Philosophy

Apply Your Knowledge

PRACTICE HEALTH

NEW SYSTEMS

TRAINING & GROWTH

DIFFERENTIATION

NEW REVENUE STREAM

Financial

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September 2020

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New Screening Protocol Mandate Leads to Two Task Forces

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

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

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It’s About the Airway: Pediatric ‘Sleep’ Therapy

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aadsm.org/resourcepreview