Early evaluation of sleep disordered breathing in kids: What is dentistry’s role?

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Conflict of interest disclosure

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1. I do not have any potential conflicts of interest to disclose, OR

2. I wish to disclose the following potential conflicts of interest:

<table>
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<tr>
<th>Type of Potential Conflict</th>
<th>Details of Potential Conflict</th>
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<td>Grant/Research Support</td>
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3. The material presented in this lecture has no relationship with any of these potential conflicts, OR

4. This talk presents material that is related to one or more of these potential conflicts, and the following objective references are provided as support for this lecture:
Kids need sleep.

- Many children develop mouth breathing or even snoring at a young age. ¹
- Research estimates that about 10% of kids snore, and about 2-4% of those have sleep apnea.²
- Manifests not as daytime sleepiness, but as behavioral problems, particularly school problems, hyperactivity, nocturnal enuresis, sleep terrors, depression, insomnia, and psychiatric problems.³

Objectives

1. Etiology of Sleep Disordered Breathing (SDB)
2. Predisposing Factors of SDB
3. Clinical Manifestations: Patient history and physical exam
4. Work Up
5. Treatment
6. Moving forward, together.
Defining sleep disordered breathing in kids

- Caused by a complete or partial episodic upper airway obstruction that occurs during sleep.

3 Major Components:
- Episodic hypoxia (low O2)
- Intermittent hypercapnia (high blood CO2)
- Sleep fragmentation
There’s a spectrum.

- 12%
- 3%

Primary Snoring
Upper Airway Resistance Syndrome
Obstructive Sleep Apnea
Prevalence

Peak incidence: 2 and 8 years of age, likely due to the relative size of lymphoid tissue in comparison with airway diameter.

M:F equal

4 to 6 times more likely in black children. ¹

Predisposing Factors

1. Adenotonsillar hypertrophy
2. Craniofacial Anatomy
3. Obesity
4. Upper airway inflammatory processes
5. Environmental exposures
6. Asthma
7. Prematurity
8. Genetic variation
9. Ankyloglossia
1. Adenotonsillar Hypertrophy

- Adenotonsillar size alone cannot predict presence of a sleep related disorder, but there is a modest positive correlation.¹

- Tonsil size was correlated with intercanine and interpmolar arch width

- Grade 4 tonsils were strongly associated with post crossbite and functional shift of the mandible.²


²Diouf, et al AJODO 2015 Feb;147(2):214-20. Image retrieved from: [https://www.google.com/search?q=adenotonsillar+hypertrophy&source=lnms&tbm=isch&sa=X&ved=0ahUKEwiy1oCSwZ_dAhVj7YMKHUuzqBFEQ_AUICigB&biw=1026&bih=671#imgrc=7mPSRHu1eWY_9M](https://www.google.com/search?q=adenotonsillar+hypertrophy&source=lnms&tbm=isch&sa=X&ved=0ahUKEwiy1oCSwZ_dAhVj7YMKHUuzqBFEQ_AUICigB&biw=1026&bih=671#imgrc=7mPSRHu1eWY_9M)
2. Craniofacial Abnormalities

- A narrow maxillary arch is directly associated with OSA in children.
- Retrognathic mandible and retractive orthodontics results in a smaller airway.

3. Obesity

- Children with obesity (especially if severe) are far more likely than lean children to have OSA, with reports of prevalence ranging from 13 to 59 percent.¹

- Obesity contributes to airway narrowing in several ways, including fatty infiltration of areas surrounding the airway, tongue, or fat pads lateral to the airway. ²

- 60-88% of obese kids have persistent SDB post adenotonsillectomy.²

4. Upper Airway Inflammatory Processes

- Both obesity and OSA are inflammatory conditions with additive effects on comorbidities that are mediated by inflammatory processes. ¹

- Comorbidities include atherogenesis/cardiovascular disease and associated lipid abnormalities, insulin resistance, and fatty liver disease. ²


Image retrieved from: https://3pw8zx30ta4c3jegjv14ssuv-wpengine.netdna-ssl.com/wp-content/uploads/sites/2/2015/03/15-RHE-532-Husni-Inset-Image-Fig-1-590pxl-width.jpg
5. Environmental Exposures

- Cigarette smoking is a major risk factor for SDB. ¹

- In the United States in 2011-2012, 40 percent of 3- to 11-year-old children overall, and 70 percent of Black children, were regularly exposed to secondhand smoke. ²

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6. Asthma

- Among children with asthma, those who are obese have a fourfold increase in their risk of OSA.
- Moreover, children with poorly-controlled asthma are much more likely to have OSA than those with well-controlled asthma.


Image retrieved from: https://i.ytimg.com/vi/sm7Jo5N8kJ0/maxresdefault.jpg
Kids with **cystic fibrosis** have mucopolysaccharides accumulating in their upper airway, predisposing them to sleep disordered breathing (SDB).\(^1\)

**Trisomy 21** (Down syndrome) has midfacial hypoplasia, a high-arched palate, macroglossia, cranial base anomalies, and hypotonia. In one report, 81 percent of children with trisomy 21 had SDB.\(^2\)

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9. Ankyloglossia

- A short lingual frenulum can lead to oral facial dysmorphism, which decreases the size of the upper airway support. \(^1\)

- A short lingual frenulum left untreated at birth is directly associated with SDB at a later age. \(^1\)

- Interferes with breastfeeding success and ultimately affects palatal growth. \(^1\)

Obtaining the Patient History
Patient History: The Overall Considerations

- Obesity
- Noisy breathers
- Chronic runny noses
- Frequent upper airway infections
- Mood disorders, bullying
- Increased risk-taking behaviors
- **Ankyloglossia**
- Bruxism
- Snoring (3 or more nts/wk)

- Developmental delay
- Difficulty in school
- Poor concentration (ADD)
- Enuresis (esp. after 6 mos. of continence)
- Nightmares / Night terrors
- Headaches
- Restless sleep
- Earaches
- Abnormal sleeping position
- Hyperactivity (ADHD)
- Breastfeeding Difficulty
Patient History: Earaches

- Consider angle of the eustachian tube
- Bottle feeding increases risk for ear infections in babies.¹
- The lymphatic system depends on muscle contraction for proper drainage.

Patient History: Abnormal Sleeping Position

Photo courtesy of Kathi Wilson, DDS, Diplomate, ABDSM.
Patient History: Hyperactivity

- There is a 42% increase ADHD prevalence in 8 years.\(^1\)
- 1 in 5 kids with a current ADHD are not receiving either medication for ADHD or mental health counseling, as of 2011.\(^1\)
- Rule out sleep pathologies!

# Patient History: Evaluating for Ankyloglossia

<table>
<thead>
<tr>
<th>For Mom</th>
<th>For Baby</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Nipple pain/discharge (cracked, bleeding, or blistered)</td>
<td>- Poor/shallow latch or an inability to latch</td>
</tr>
<tr>
<td>- Mastitis</td>
<td>- Slipping off nipple</td>
</tr>
<tr>
<td>- Thrush</td>
<td>- “Lazy nurser”-falling asleep before finishing a feeding</td>
</tr>
<tr>
<td>- Clogged ducts</td>
<td>- Colic and reflux</td>
</tr>
<tr>
<td>- Low milk supply</td>
<td>- Gassiness</td>
</tr>
<tr>
<td>- Overactive let down</td>
<td>- Poor weight gain</td>
</tr>
<tr>
<td>- Vasospasms</td>
<td>- Dribbling milk from sides of mouth</td>
</tr>
<tr>
<td></td>
<td>- Chomping, chewing or compressing the nipple (leaving the nipple in a lipstick shape)</td>
</tr>
<tr>
<td></td>
<td>- Clicking sounds, choking, gagging</td>
</tr>
</tbody>
</table>
Other Comorbid and Confounding conditions

**OSA Comorbidities**
- Systemic hypertension
- Daytime sleepiness, irritability
- Academic difficulties, frontal lobe executive function
- Failure to thrive/growth retardation/underweight

**Coexisting Conditions**
- GERD
- Asthma
- Recurrent otitis media
- Pressure equalization tubes
- Metabolic syndrome
- Insulin resistance

The Physical Exam
# The Physical Exam

## Extraoral Exam
- Mouth breather?
- Speech issues?
- Frequent yawning/sighing?
- Symmetry?
- Profile-max/mand deficient?

## Functional Exam
- Tongue thrust on swallowing?
- Tongue position at rest?
- TMJ clicking/popping?
- Bruxism?
- Rest v. swallowing: masseter
- Buccinator, mentalis, orbicularis oris
- Thumb/finger/pacifier habit?

## Intraoral Exam
- Tonsils? Grade?
- TOTS?
- Dentition-primary/permanent/mixed
- Missing teeth? Occlusion-I/II/III
- Crossbite?
- Crowding?
- Impinging?
- **Archform**?
Physical Exam: Facial Growth and Mouth Breathing

- Forward head posture
- Retrognathic mandible
- Increased lower face height
- Hypotonia- A primary element in development of orofacial anatomic abnormalities involved with SDB (MUSCLE-BONE relationship)

1Huang and Guilleminault Font Neurol. 2012;3:184
Physical Exam: Evaluating the Infant Frenulum

*Kotlow Diagnostic criteria (one) for clinically apparent tongue-ties in infants

**Type I (*4LK) - total tip involvement

Type II (*3LK) Midline-area under tongue (creating a hump or cupping of the tongue)

Type III (*2LK) Distal to the midline. The tongue may appear normal

**Type IV (*1LK) Posterior area which may not be obvious and only palpable, Some are submucosally located

**Lactation consultants diagnostic criteria

Examination Technique For Tongue-Tie and Lip-Tie

from Bobby Ghaferi
Normal measurement for maximum opening: 42-65 mm
Tongue on the roof of the mouth
Tongue Restriction Grading

Functional classification of ankyloglossia based on tongue range of motion ratio (TRMR)

Grade 1 Functioning
TRMR > 80%

Grade 2 Functioning
TRMR 50-80%

Grade 3 Functioning
TRMR < 50%

Grade 4 Functioning
TRMR < 25%

Figure 2: Examples of varying degrees of ankyloglossia categorized by tongue range of motion ratio (TRMR) grading (ratio of MOTTIP to interincisal mouth opening [MIO]).

Ratio: maximum opening to tongue on the roof of the mouth (TRMR)
Measuring maxillary vertical growth can be an early indicator that the maxilla is growing down and not out, which can cause eventual retrognathic mandible and airway restriction.¹

Image retrieved from: https://encrypted-tbn0.gstatic.com/images?q=tbn:ANd9GcRqDcZ07OA3Kp5alvpobSXfniHwC0spaq2YUs8Rbd7HtMAMfObkTjg

Mew Indicator Ruler

"CHILD-IDEAL" Females - 21mm + current age
Males - 23mm + current age

www.wmiorthotropics.org
The Work Up

Pediatric Polysomnography (PSG)

- PSG indicated for all with snoring and signs/sx of OSA.¹
- Prior to any adenotonsillectomy. ²
- One night usually sufficient to diagnose OSA, but not for sleep architecture. ¹
- Able to classify OSA severity. ¹
  - Helps determine risks for complications and sequelae
  - Identify those at greater risk of post-op complications
  - Identify those likely to need a post-op PSG

¹Marcus et al Pediatrics 2012;130:576-84
Interpreting results of a PSG

- Apnea: Any pause in respiration for 2 breaths (*versus 10s in adults*)
- Hypopnea = 50% reduction in airflow for 2 breaths and 3% desat or arousal.
- Apnea hypnotic index (AHI) on 1-5 events/hour is used most often to identify children with OSA.
  - **MILD**: 1.5-5 AHI
  - **MODERATE**: 6-9 AHI
  - **SEVERE**: 10 or > AHI OR SpO2 < 80%
  - **OBSTRUCTIVE HYPOVENTILATION**: ≥ 25% of TST with hypercapnia-PaCO2 > 50 mmHg
The Treatment
<table>
<thead>
<tr>
<th>Team</th>
<th>Members</th>
<th>Job</th>
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<tbody>
<tr>
<td><strong>The Muscle Team</strong></td>
<td>Myofunctional Therapy</td>
<td>● Diagnose and release tethered oral therapies (TOT)</td>
</tr>
<tr>
<td></td>
<td>Lactation (IBCLC)</td>
<td>● Improve muscle function and posture</td>
</tr>
<tr>
<td></td>
<td>Dentists</td>
<td>● Correct bad muscle habits/tone</td>
</tr>
<tr>
<td><strong>The Tissue Team</strong></td>
<td>ENT Physicians</td>
<td>● Diagnose and correct nasal/airway obstructions</td>
</tr>
<tr>
<td></td>
<td>Immunologists</td>
<td>● Improve nasal breathing and allergy symptom relief</td>
</tr>
<tr>
<td></td>
<td>Sleep Physicians</td>
<td>● Help maintain airway patency</td>
</tr>
<tr>
<td><strong>The Bone Team</strong></td>
<td>Dentistry</td>
<td>● Direct craniofacial growth</td>
</tr>
<tr>
<td></td>
<td></td>
<td>● Utilize early interventions to prevent sleep pathologies</td>
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<tr>
<td></td>
<td></td>
<td>● Promote forward growth of the maxilla</td>
</tr>
<tr>
<td></td>
<td></td>
<td>● Expansion of primary dentition</td>
</tr>
<tr>
<td></td>
<td></td>
<td>● Bring mandible forward</td>
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The problem with adenotonsillectomy

- While this is the medical gold standard, there is a lack of proven longitudinal effectiveness.

- Despite short term improvements after an Adenotonsillectomy, continued use of the oral breathing route may be associated with long term airway problems.¹

- Younger patients tend to do better longer with an adenotonsillectomy, and when recurrence does appear, it tends to be less severe→ treat early. ²


Image retrieved from: http://tonsillitispictures.org/images/Tonsil-Stones-Pictures.jpg
Treatment Gold Standard: Eliminate Oral Breathing

- Improve oral posture to stimulate maxillary growth
- Restore nasal breathing during sleep and wakefulness.
- Preventative measures in high risk groups, such as preemie babies
- Myofunctional therapy is a key part of OSA treatment
- Comorbidity treatment


https://2o1gvp31ohpw2js02z3a5m0i-wpengine.netdna-ssl.com/wp-content/uploads/2016/06/iStock_000017812712Medium-270x270.jpg
Let’s change our approach

- Early recognition of growth discrepancies
- Early intervention
- a “wait and see” approach can have detrimental effects
Ways to Influence Growth

- Biobloc Orthotropics
- Gnathologic Orthopedics
- Functional Appliances
  - Healthy Start
  - Myobrace
Talking Through Cases
What’s the problem?
What’s the problem?
What’s the problem?
What’s the problem?

Lucinda age 9  
Age 16  
‘K’ age 8 with a flat face  
14 months later after Orthotropics
What’s the problem
Early Intervention is CRITICAL.

Be able to identify a problem and have a plan to correct

Get the training you need to be a good team member

Start the conversations with the parents
Thank You