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Healthy Breathing, 'Round the

Problems with airway functioning due to chronic conditions can impact children's health. And SLPs, along with other professionals, are on the front lines of identification and intervention.

Nicole Archambault EdS, MS, CCC-SLP

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When was the last time you thought about breathing? Every 24 hours, people take roughly 28,000 breaths, amounting to some 700 million breaths over the course of a typical lifetime. Breathing delivers the oxygen to our blood that fuels every living cell in our body—and the brain consumes 20 percent of that oxygen.

Even small disturbances in breathing can have substantial (and negative) effects on functioning, health and behavior.

Fortunately, for most of us, breathing occurs automatically and unimpeded, without

conscious effort. Unfortunately, in today's fast-paced, achievement-driven world, healthful and proper breathing is often taken for granted—especially at night, during sleep. We spend roughly one-third of our lives asleep, and how we breathe during that time has significant implications for our quality of life during the other two-thirds of the time, when we are awake.

Breathing effects are particularly important during childhood development (see sources)—and this is illuminated on the caseloads of pediatric speech-language pathologists when we see airway function disorders (AFDs). These disorders arise from compromised airway function at any level of the airway (secondary to structural and/or functional deficiencies that occur during a 24-hour period) and interfere with a range of human functions.

Meanwhile, sleep-disordered breathing (SDB) refers to collapse at any level of the upper airway resulting in abnormal breathing patterns during sleep. SDB can lead to reduced oxygenation of the brain, change in neural physiology and function, and a lack of restorative sleep essential to optimal daytime functioning.

There is much SLPs can do to intervene and help (respiratory obstruction, pharyngeal anomalies and **orofacial myofunctional disorders are within SLPs' scope of practice**). With our understanding of the orofacial complex and the interplay between structures, functions and behaviors, SLPs are well-suited to work as part of an interdisciplinary team to identify, manage and help prevent AFDs.

We can, for example, watch for telltale behavioral signs, such as excessive fidgeting, reduced attention and emotional outbursts; screen for mouth breathing and other symptoms of SDB; provide instruction for retraining of nasal breathing and proper oral functions; and share strategies for better sleep habits (aka sleep hygiene, see sidebar below).

Airway function disorders can interfere with language, learning and academics, executive function skills, socialization, self-regulation, and behavioral and emotional health.

Spectrum of sleep-disordered breathing

For SLPs, it is important to consider that the origins of SDB are rooted in daytime breathing patterns (such as mouth breathing). An already-compromised airway in the

daytime does not improve in a supine position for sleep, when the oropharyngeal muscles are relaxed. The spectrum of SDB includes the following:

- **Mouth breathing**, in which a person ceases breathing solely through the nose or supplements nasal breathing with oral breathing. It is seen in 55 percent of children (see sources).
- **Primary snoring** (without obstructive sleep apnea), in which airway tissue vibrates, causing breathing noises during sleep. It is associated with neurocognitive deficits and effects on attention in children (see sources). It occurs in 6 to 34.5 percent of children (see sources).
- **Upper airway resistance syndrome (UARS)** is characterized by increased efforts to breathe and frequent sleep arousals, leading to fragmented sleep. To date, its prevalence has not been studied.
- **Obstructive sleep apnea (OSA)** in which a person has repeated episodes of partial or complete upper-airway obstruction during sleep, resulting in an intermittent halt to breathing. It has been found in up to 5 percent of children, with peak prevalence at 2 to 8 years old (see sources). It can be associated with morbidity in children.

The ability to breathe effortlessly and quietly through the nose with the tongue suctioned up and the lips gently closed is essential to optimal craniofacial growth and development. Healthy nasal breathing supports proper oral functions (including oral resting postures, swallowing patterns, chewing and speaking), voicing, and overall body posture. When nasal breathing goes awry, orofacial myofunctional disorders may result, raising red flags to clinicians.

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Impact on functioning

Given that airway function disorders are not typically a major focus in graduate school, SLPs may wonder how pertinent airway issues are to their work with children. Research findings indicate airway function disorders are relevant to our work (see sources) because in addition to underlying and/or affecting oral functions, AFDs can interfere with language, learning and academics, executive-function skills (memory, attention and problem-solving), socialization, self-regulation, and behavioral and

emotional health.

In 2016, the American Academy of Physiological Medicine and Dentistry called this often-overlooked and unmitigated problem in children “the hidden airway epidemic.” With this in mind, consider the following findings of several studies (see sources for each):

- *25–50 percent of preschoolers showed sleep problems, which were associated with behavior problems* (**Journal of Developmental & Behavioral Pediatrics**).
- *An estimated 50–80 percent of children with autism spectrum disorder (ASD) experience sleep problems* (**Seminars in Pediatric Neurology**), with all core symptoms of ASD exacerbated in their presence.
- *Phonology was affected in 62.7 percent of children with obstructive SDB* (**Clinical Linguistics and Phonetics**).
- *Children who mouth-breathe also exhibit daytime sleepiness, poor brain oxygenation, and immature auditory processing, which can lead to learning disabilities* (**Jornal de Pediatria**).
- *Mouth-breathing is associated with alterations in muscle activity for speaking, chewing and swallowing* (**American Journal of Orthodontics and Dentofacial Orthopedics**).
- *Approximately 62 percent of 6-year-old children with obstructive sleep disorders demonstrated moderate or greater difficulties with speech and swallowing* (**Archives of Otolaryngology–Head and Neck Surgery**).
- *Attention-deficit hyperactivity disorder (ADHD) symptoms may be related to SDB and improve after adenotonsillectomy* (**Sleep Medicine Reviews**). The authors suggest patients with ADHD symptomatology be screened for SDB.

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IPP for airway health

To see the effects of SDB, consider the case of Mason, a gifted 8-year-old who excels at reading and struggles to be accepted by his peers. Family and classroom reports indicate difficulty regulating emotional responses, as seen in dramatic meltdowns. He has a history of environmental allergies and upper respiratory infections. He frequently chews on his clothes.

Closer examination reveals venous pooling under the eyes, a retrognathic mandible (recessed lower jaw), malocclusion, high narrow palate, enlarged tonsils and restricted lingual frenum (tongue-tie). Prior speech-language treatment has yet to resolve an interdentalized lisp for phonemes /s/ and /z/ and low tongue placement for producing lingual alveolar sounds. Mason speaks with glottal fry. While sleeping, he reportedly snores lightly, mouth-breathes, moves a lot, and wets his bed (enuresis).

Fortunately for children like Mason and others (see more case histories online) who have airway function disorders, SLPs can collaborate on identification and treatment. The multifaceted impact of abnormal daytime and nighttime breathing patterns on the whole child requires a whole-team approach to treatment. At the first sign of suspected breathing problems, SLPs should refer families to pediatricians and medical airway specialists (otolaryngologists, pulmonologists, sleep surgeons) for diagnosis.

Depending on a child's individual needs, SLPs should also steer parents to other key professionals, such as allergists, airway-centric pediatric dentists and orthodontists, osteopathic medical practitioners, orofacial-myofunctional therapists, breathing re-educators, physical and occupational therapists, lactation consultants, gastroenterologists and neuropsychologists.

In our own practice, SLPs start flagging signs of mouth-breathing and SDB by incorporating a few simple procedures into our screening practices, as stand-alone screenings, as part of more comprehensive orofacial myofunctional evaluations, or as part of larger assessments. First, we look for predisposing risk factors (see list below) and evidence of mouth-breathing and SDB in chart reviews and initial intakes. Then we collect information on potential signs and symptoms of airway function disorders by examining the child's orofacial structures and functions and administering a sleep questionnaire.

We also collect and factor in parent reports, classroom observations, teacher reports on learning and behaviors, and other interdisciplinary reports from, for example, pediatricians, otolaryngologists and dentists. And we watch for *problem behaviors* that may indicate underlying airway function disorders (see sources):

- Increased fidgeting and hyperactivity.
- Decreased attention, recall and visual-fine motor skills.
- Impaired executive function skills.
- Poor academic performance.
- Decreased self-regulation and increased aggression.

To screen for predisposing risk factors for sleep-disordered breathing, we look into *mouth-breathing red flags* (see sources).

- Open or pursed lips/dry lips.
- Low forward tongue position.
- Short upper lip with reduced function.
- Voluminous and everted lower lip.
- Anterior oral seal: lip to tongue contact.
- Hypotonic oral facial musculature—oral areas show low muscle tone.
- Forward head posture.
- Dolichofacial type (“long face”).
- Facial retrusion—some oral structures (for example, the lower mandible) are recessed.
- Posterior crossbite, open bite (anterior, posterior or combination), increased overjet.
- Nasal congestion.
- Drooling.
- Halitosis.
- Xerostomia (dry mouth).
- Hyponasal speech—speech sounds nasal, like it does when someone has a cold.

Orofacial myofunctional disorders can serve as clinical markers for SDB and include the following *structural and functional symptoms*: enlarged tonsils; elongated uvula; narrow maxillary arch (high narrow palate that does not accommodate the tongue comfortably at rest); tongue scalloping (tongue does not have enough room in the oral cavity); restricted lingual frenum; orofacial pain with or without headache; interdentalized speech sounds (/s, z, t, d, n, l/); abnormal swallow patterns (such as tongue-thrust swallows); impaired chewing; and picky eating.

Nighttime red flags

SLPs don’t need to be in the same room as a sleeping child to pick up on signs and symptoms of SDB. We can learn a lot through parent interviews and intake and by administering sleep questionnaires, such as the Childhood Sleep Habits Questionnaire, Pediatric Sleep Questionnaire, Sleep Disturbance Scale for Children, or the BEARS.

Most parents do not sleep in the same room as their children, but we can empower them to be sleep “detectives,” gleaning insights into their children’s nighttime sleep breathing patterns by watching/listening for the following red flags:

- Cessation of breathing and/or gasping for air—this warrants immediate

attention from a physician.

- Snoring.
- Audible breathing.
- Open mouth posture.
- Grinding teeth (nocturnal bruxism): a micro-arousal that alerts the body to breathe.
- Enuresis—can result from a diuretic hormone produced by an overworked heart.
- Sweating.
- Positional changes and/or hyperextension of the neck.
- Frequent arousals leading to fragmented sleep.
- Restless sleep.
- Night terrors, sleep walking.

Limiting daily screen time can help prevent “tech neck” that may further compromise an obstructed airway. Promoting healthier sleep practices is also key.

SLPs on the front lines

As part of an interdisciplinary team and with appropriate training, SLPs can also provide key management of abnormal breathing patterns and oral functions within orofacial myofunctional treatment programs. In fact, orofacial myofunctional treatment is associated with a **62-percent reduction in apnea-hypopnea index (AHI) scores in children with obstructive sleep apnea**, finds a recent meta-analysis.

The study authors conclude that, alongside other established interventions, oropharyngeal exercise (myofunctional therapy) can be beneficial for pediatric obstructive sleep apnea. In another study, Anna Sujanska and colleagues contend that oropharyngeal exercise and orthodontic treatment are the most promising in the alternative modalities.

Many parents send their children to an orthodontist for straight teeth and beautiful smiles, but airway-centric dentists and orthodontists can help guide children’s craniofacial growth by using appliances to remodel and reposition the upper and lower jaws in relationship to the airway. The most common medical treatment is surgical removal of hypertrophic tonsils and/or adenoids, with other effective treatments including continuous positive airway pressure (CPAP), pharmacological interventions (nasal steroids), lifestyle changes (weight loss), and sleep hygiene

Sleep on this: Prevention

Daily ergonomics also factor into airway health in children. A practice as simple as limiting daily screen time can help prevent “tech neck” (forward head posture) that may further compromise an obstructed airway. Promoting healthier sleep practices (see box on sleep hygiene, below) is also key.

Sleep is a family affair. We can promote it by fostering a sleep mindset: the belief that sleep is an essential human behavior that drives health, wellness, growth and development, and requires the practice of sleep wellness habits. The following practices can help create this mindset.

- **Starting young.** Many infant and toddler board books incorporate a theme of sleep. From birth, children have the potential to listen to these stories. Use this early literacy practice as a way to help children connect to the importance of sleep.
- **Talking about it.** Parents continually convey the importance of hydration and nutrition with their children. Encourage parents to have developmentally appropriate conversations with their children about the importance of sleep and nighttime sleep breathing. Help them learn that breathing, like food and water, is necessary fuel for the brain and body. Verbalize sleep expectations.
- **Modeling healthy sleep habits.** Children learn in abundance from watching their parents. Encourage parents to consistently model healthy sleep hygiene practices.
- **Empowering.** Help even the youngest of children to be interactive sleep-hygiene partners by giving them choices of which electronics to turn off first and where to put their electronics to bed, which pajamas to wear, which relaxation activity they will do, and which bedtime story they will read. This can help empower them to carry over these habits into adulthood.
- **Reflecting.** Show children how their bedtime routines and sleep affect the quality of their functioning and behavior throughout the day. Ask them to reflect on which sleep hygiene practices best prepare their bodies for sleep.

SLPs can play a critical role in the prevention of, screening for, and interdisciplinary collaboration to diagnose SDB and related airway problems. We are in a position to intervene before significant problems take hold and become bigger issues for children, families, schools and society. By getting to the cause of the symptoms we

see, we can help improve treatment outcomes, while ensuring that all our young clients live, learn and sleep with optimal airway function, 24/7.

Practice Sleep Hygiene

SLPs can help children and families optimize sleep by encouraging them to adopt practices that promote sleep hygiene (healthy sleep patterns):

- Establish and maintain nightly bedtime routines that signal to the body that it's sleep time.
 - Keep bedtimes consistent Monday through Sunday to promote a natural sleep-wake cycle.
 - Turn down the lights to prepare the body for impending sleep (light exposure before bed can suppress production of sleep-promoting melatonin).
 - Stay cool—lightweight bedding and pajamas and cool bedrooms help reduce core body temperature. This is essential for inducing sleep.
 - Unwind the mind and body through, for example, massage, simple yoga poses, breathing exercises or meditation as a family.
 - Share an attitude of gratitude: Have a child consider what they're grateful for from their day to help calm them for sleep.
 - Put electronics and screens away, preferably in a separate room, at least one hour before bedtime, because the light and stimulation can compromise sleepiness.
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Faces of Airway Dysfunction Disorders

- **Jack**, age 5, has a history of airway obstruction leading to tonsillectomy and adenoidectomy. He has nasal congestion and seasonal allergies, and mouth-breathes more than 50 percent of the time. He struggles to make it through his day without a nap. While Jack reportedly has both "good" and "bad" days, he is prone to outbursts, shows aggression towards others, fails to follow adult directions, is reluctant to speak, and has become known as the class bully. At night, he struggles to fall asleep and stay asleep, often keeping his family awake for hours.
- **Will**, age 6, is bright but barely sits still or focuses in class, and acts and speaks impulsively. When not overly active, his eyes are glassy and he slumps in his chair or lies on the floor with little energy. Will is kind and maintains a strong desire to be liked by others, although peer responses to his behavior have led

him to believe the worst in himself. Will often struggles to find his words, talks in circles, and struggles to filter his thoughts. His speech is hyponasal (often a sign of enlarged adenoids), his palate is high and narrow, his oropharyngeal space is small, and his teeth reveal wear patterns suggestive of nocturnal bruxism (a micro-arousal to alert the body to breathe). Will has struggled to sleep for nearly three years, often becoming so restless that he falls out of bed and then falls back to sleep, sitting up to maintain his airway. He resists going to bed at night, snores loudly, talks in his sleep, and wakes up feeling tired, even after ample sleep. His school thinks he has attention-deficit hyperactivity disorder (ADHD).

Risk factors for Sleep-Disordered Breathing

- Enlarged tonsils and/or adenoids
 - Mouth breathing
 - Nasal abnormalities such as a deviated septum, enlarged turbinates, or nasal polyps
 - Nasal congestion
 - Chronic rhinitis
 - Waist circumference/body mass index (BMI)
 - Gastroesophageal reflux disease (GERD)
 - Low muscle tone
 - Craniofacial syndromes or craniofacial growth alterations
 - Prematurity
 - Traumatic birth
 - Sex: males are two times more likely to have SDB
 - Ethnicity: African-Americans are a higher risk
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Author Notes

Nicole Archambault, EdS, MS, CCC-SLP, is founder and executive director of Minds In Motion, a speech-language pathology, orofacial myofunctional therapy and sleep literacy clinic in Santa Monica, California. She is the myofunctional therapy section leader of the American Academy of Physiological Medicine and Dentistry.

nicole@mindsinmotiontherapy.com

Additional Resources

The Tongue Was Involved, But What Was the Trouble?

Nicole Archambault Besson, The ASHA Leader, 2015

Case Puzzler

The ASHA Leader, 2015

Potential Gatekeepers for Airway-Function Disorders

The ASHA Leader, 2018

Climbing Out of Limbic

Nicole Archambault Besson, The ASHA Leader, 2017

Unsafe Chewing: Choking and Other Risks


Nicole Archambault et al., The ASHA Leader, 2019

How are covid-19 symptoms changing? 


Mun-Keat Looi et al., The BMJ, 2023

Sleep disorders are an overlooked risk factor for non-communicable diseases 


Mark Thomaz Ugliara Barone et al., The BMJ, 2023

Tongue Position Variability During Sustained Notes in Healthy vs Dystonic Horn Players Using Real-Time MRI 

Peter W Iltis et al., International Forestry Review, 2019

Bruguiera (Rhizophoraceae) in the Indo-West Pacific: a morphometric assessment of hybridization within single-flowered taxa 

N.C. Duke et al., Blumea - Biodiversity, Evolution and Biogeography of Plants, 2011

Generic circumscriptions in Geoglossomycetes 

V. P. Hustad et al., Persoonia - Molecular Phylogeny and Evolution of Fungi, 2013

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