



INTRODUCTION

Sleep disordered breathing (SDB) is a general term for breathing difficulties affecting sleep. This includes sleep in pediatric populations. Sleep disordered breathing can range from sleep-related hypoxemia, sleep-related hypoventilation, central sleep apnea, and obstructive sleep apnea (OSA) disorders. Of the OSA disorders, the spectrum includes: primary snoring (PS), upper airway resistance syndrome, obstructive hypoventilation and obstructive sleep apnea syndrome.

Attention Deficit Hyperactivity Disorder (ADHD) is a neurodevelopmental disorder usually diagnosed in childhood and managed throughout the child's life, into adulthood, and across the life course. Research has shown associations between sleep disorders which are underdiagnosed and undertreated. This literature review aims to shed light on the relationship between sleep disordered breathing (SDB) and ADHD as well as the utility of incorporating the dental professional in screening and treatment. The dental professional is equipped to screen, provide holistic treatment, and options other than pharmaceuticals to pediatric patients. Dental treatment options include appliance therapy, myofunctional therapy and orthodontia, all which are a viable supplement to traditional therapies. Traditional treatment includes the use of sleep machines (CPAP and others), surgical removal of the tonsils and adenoids (adenotonsillectomy) along with behavioral therapy.

There are socioeconomic factors as well as complications of untreated SDB and ADHD. Complications include: behavioral and learning problems which affect academic achievement, comorbidities including impaired growth, cardiovascular problems, obesity, insulin resistance, depression, anxiety and substance abuse challenges. Socioeconomic impacts include undertreated and underdiagnosed sleep disorders, workforce shortages, quality and access to medical and dental care as well as healthcare disparities in communities of color. The intent of this review is to shed light on SDB, ADHD, and the dental professional's participation in the multidisciplinary team.

HISTORY

- Records of Obstructive Sleep Apnea (OSA) date back more than 2,000 years.
- The 19th century term "Pickwickian Syndrome" was used to describe the apnea events that occurred, usually in obese patients.
- Polysomnography was first used and researched in 1965
- ADHD records date to the 20th century with research noting the childhood story Fidgety Phil written by Heinrich Hoffman in 1844.
- In 1902, British pediatrician Sir George Frederick Still noted behavioral patterns of children, including difficulty focusing, inattentiveness and easily distracted

SIGNS, SYMPTOMS and COMPLICATIONS

Signs and Symptoms

- Snoring
- Excessive daytime sleepiness
- Poor school performance
- Dry mouth or sore throat
- Macroglossia
- Diaphoresis (bed-wetting)
- Attention problems
- Aggressive behavior

Complications

- Macroglossia
- Allergies
- Obesity (metabolic consequence)
- Impaired growth
- Cardiovascular complications
- Behavioral and learning difficulties
- ADHD (developmental delay)
- Comorbid sleep disorders (insomnia and restless leg syndrome)

SCREENING MECHANISMS



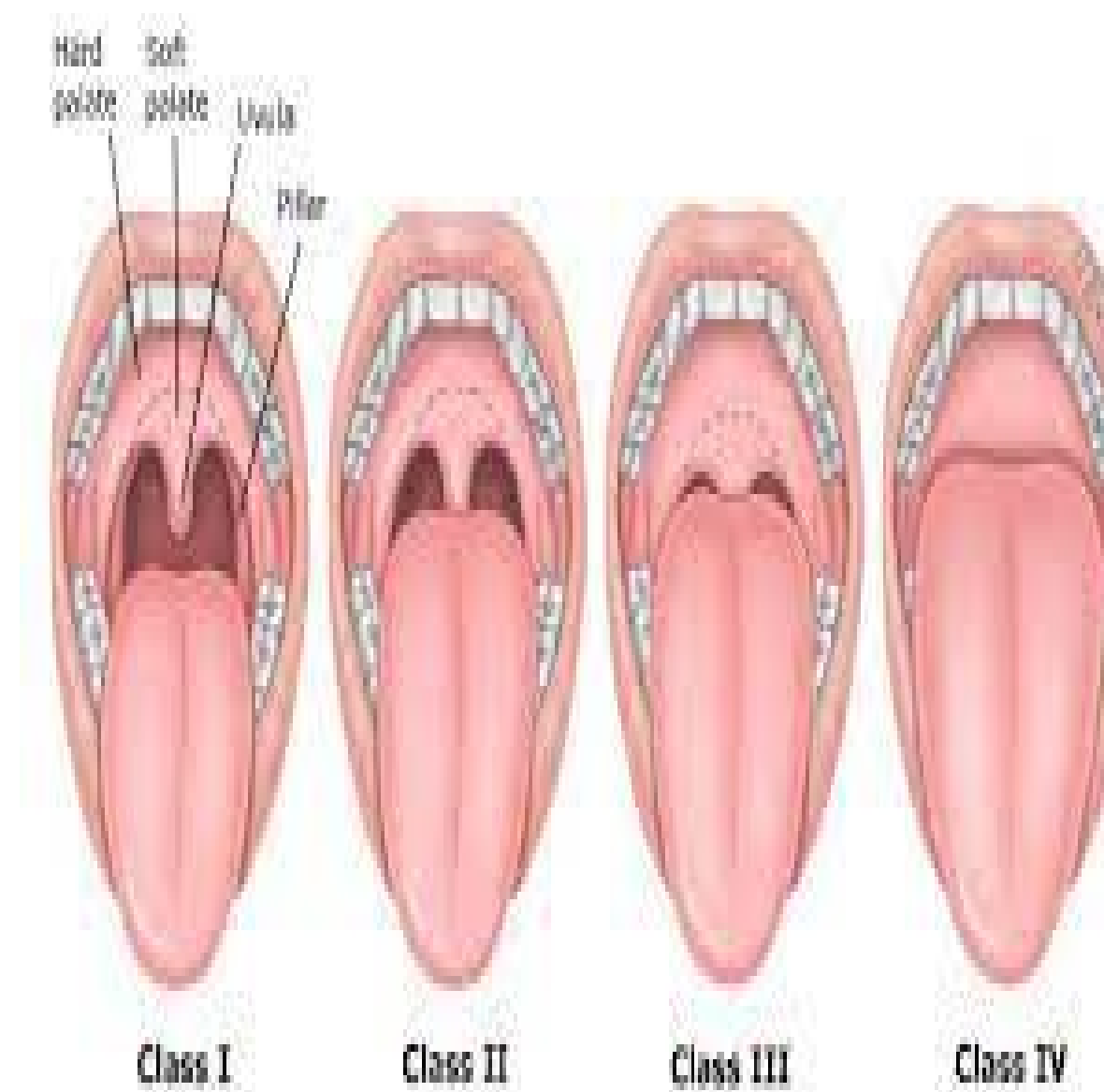
Pediatric Sleep Questionnaire: Sleep-Disordered Breathing Subscale 070129

Child's Name: _____ Study ID #: _____
Person completing form: _____ Date: _____

Please answer these questions regarding the behavior of your child during sleep and wakefulness. The questions apply to how your child acts in general during the past month, not necessarily during the past few days since these may not have been typical if your child has not been well. You should circle the correct response or *prior* your answers neatly in the space provided. A "Y" means "yes," "N" means "no," and "DK" means "don't know."

1. WHILE SLEEPING, DOES YOUR CHILD:					
Snore more than half the time?	Y	N	DK	A2	
Always snore?	Y	N	DK	A3	
Snore loudly?	Y	N	DK	A4	
Have "heavy" or loud breathing?	Y	N	DK	A5	
Have trouble breathing, or struggle to breathe?	Y	N	DK	A6	
2. HAVE YOU EVER SEEN YOUR CHILD STOP BREATHING DURING THE NIGHT?	Y	N	DK	A7	
3. DOES YOUR CHILD:					
Tend to breathe through the mouth during the day?	Y	N	DK	A25	
Have a dry mouth on waking up in the morning?	Y	N	DK	A26	
Occasionally wet the bed?	Y	N	DK	A32	
4. DOES YOUR CHILD:					
Wake up feeling unrefreshed in the morning?	Y	N	DK	B1	
Have a problem with sleepiness during the day?	Y	N	DK	B2	
5. HAS A TEACHER OR OTHER SUPERVISOR COMMENTED THAT YOUR CHILD APPEARS SLEEPY DURING THE DAY?	Y	N	DK	B4	
6. IS IT HARD TO WAKE YOUR CHILD UP IN THE MORNING?	Y	N	DK	B6	
7. DOES YOUR CHILD WAKE UP WITH HEADACHES IN THE MORNING?	Y	N	DK	B7	
8. DID YOUR CHILD STOP GROWING AT A NORMAL RATE AT ANY TIME SINCE BIRTH?	Y	N	DK	B9	
9. IS YOUR CHILD OVERWEIGHT?	Y	N	DK	B22	
10. THIS CHILD OFTEN:					
Does not seem to listen when spoken to directly.	Y	N	DK	C3	
Has difficulty organizing tasks and activities.	Y	N	DK	C9	
Is easily distracted by extraneous stimuli.	Y	N	DK	C8	
Fidgets with hands or feet or squirms in seat.	Y	N	DK	C10	
Is "on the go" or often acts as if "driven by a motor".	Y	N	DK	C14	
Interrupts or intrudes on others (eg., butts into conversations or games).	Y	N	DK	C18	

Thank you!



- Medical, Dental, Social History (with probing questions)
- Oral Exam
- History of Allergies and Sleep Disturbance
- Sleep Questionnaires
- Adenotonsillectomy
- History of Sleep Study (polysomnography: overnight and cardiorespiratory)

SDB and ADHD ASSOCIATION: THE LITERATURE

- The relationship between ADHD and SDB (especially OSA) exacerbate the symptoms of the other (Urbano et al., 2021)
- Fragmented sleep and sleep deprivation worsen OSA symptoms and ADHD behaviors (Urbano et al., 2021)
- Medical management with intranasal steroids and montelukast yields insufficient evidence for recommendation (Urbano et al., 2021)
- Adenotonsillectomy 30 and 90 days after surgery note improvement in ADHD symptoms (Ahmadi et al., 2016)
- Adenotonsillectomy 3 and 6 months post surgery note pediatric patients with SDB and ADHD experienced a significant decrease in ADHD symptoms (Amiri et al., 2015)
- Research of OSA and ADHD resolution in adults suggests a continued association; however, more research is needed (Hesselbacher et al., 2019)

INCORPORATING THE DENTAL TEAM

- Incorporate the dentist, dental hygienist and dental assistant in the screening, treatment planning and treatment process
- Recommend dental sleep medicine and dental appliance therapy as a treatment option
 - Ensure billing and front desk staff are familiar with ICD as well as CDT codes for insurance filing and reimbursement
- Explore myofunctional therapy as early intervention
- Attend continuing education courses and webinars
 - Consider certifications for the team
- Conduct thorough screenings in your office or clinic using the Pediatric Sleep Questionnaire (PSQ)
- Collaborate with specialists (allergist, pulmonologist, otolaryngologist, sleep medicine specialists)
- Utilize evidence-based research of SDB and ADHD for practice recommendations

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