Abstract #:

Cone-Beam Computed Tomography (CBCT) Evaluation of Oropharyngeal Airway Dimensions in 4–6-Year-Old Children with Chronic Respiratory Disorders and Their Association with Pediatric Sleep Questionnaire (PSQ) Scores

Shin J, Alvarez M, Kerin CA, Kesterke MJ
Texas A&M College of Dentistry, Dallas, TX
U.S. Army Dental Corps

OBJECTIVES

1. To evaluate elevated Pediatric Sleep Questionnaire (PSQ) Scores with oropharyngeal airway dimensions on Cone-Beam Computed Tomography (CBCT) scans of 4–6 year-old children.

2. To investigate whether an association exists between an increased risk of airway-related disturbances with decreased oropharyngeal airway dimensions.

BACKGROUND

Chronic mouth breathing in non-syndromic children is more than a minor habit—it can negatively impact craniofacial growth and dental development; this concept has been extensively discussed in literature [1]. If left untreated, this often can result in a long, narrow face, poor jaw alignment, crossbites, anterior open bites and crowded teeth. It can also affect the oral cavity and increase the risk for dental caries and periodontal disease.

Pediatric sleep-disordered breathing (SDB) is an abnormal breathing pattern during sleep that can range from simple snoring to repetitive pauses in breathing called sleep apnea. Children with SDB struggle with poor sleep, this can lead behavioral and academic performance problems, and long-term health issues such as metabolic, and cardiovascular disease.

Early screening of children at high risk of SDB is essential, as timely intervention during growth years can prevent or mitigate craniofacial changes and health complications. Pediatric dentists play a key role in screening children for SDB at an early age; they can accomplish this by obtaining proper history, performing comprehensive clinical exams and utilizing tools like the Pediatric Sleep Questionnaire (PSQ). Figure 6

REFERENCES

1. Palomo, Juan Martin, et al. *"Sleep-Disordered Breathing and Orthodontics: An American Association of Orthodontists White Paper Update."* **American Journal of Orthodontics and Dentofacial Orthopedics**, 2026, https://doi.org/10.1016/j.ajodo.2026.01.014
2. American Academy of Pediatric Dentistry. [ASA Policy on OSA]. The Reference Manual of Pediatric Dentistry. Chicago, Ill.: American Academy of Pediatric Dentistry; 2025:[145-148].
3. Coppelson, Kevin, et al. *"Does Head and Neck Posture Affect Cone-Beam Computed Tomography Assessment of the Upper Airway?" Journal of Oral and Maxillofacial Surgery 81*, 2023 :[721-733].

MATERIALS AND METHODS

This retrospective cohort chart review included 4–6-year-old patients at Beyond Pediatric Dentistry treated between January 1, 2024 and August 31, 2025 who completed a PSQ and underwent CBCT imaging as part of routine airway evaluation. Figure 5

A single calibrated practitioner extracted demographic data, medical/dental history, PSQ scores, and CBCT airway measurements. A 22-item PSQ screening form was completed by parents prior to the patient assessment and stratified by an elevated PSQ Score ≥ 8 (33% elevated risk for SDB) or lower PSQ Score < 8 (less than 33% risk for SDB). All CBCT measurements (minimum airway space (MAS), porion vertical to A-point (PV-A) and total airway volume) were performed by a board-certified oral and maxillofacial radiologist to ensure consistency.

Data analysis was completed using correlation and descriptive statistics. The standard statistical software, Kendall's Tau (τ) correlation coefficient, was used for non-parametric analysis of ordinal data. Statistical significance was set at α = 0.05.

Inclusion criteria: Ages 4–6, completed PSQ, CBCT imaging, ≥36 weeks gestation, stable and well-controlled medical condition.
Exclusion criteria: History of T&A, craniofacial syndromes, prior orofacial myofunctional therapy, uncontrolled medical conditions, prematurity (<36 weeks).

RESULTS

- 124 patients met the selection criteria.
- The average of minimum airway space in males was 82.05 and in females was 62.35. Figure 4
- The average of PV-A in males was 80.37 and in females was 78.44. Figure 4
- The average of oropharyngeal total airway volume in males was 5.93 and in females was 5.25. Figure 4
- The average of MAS, PV-A, and total airway volume were greater for males compare to female. Figure 4
- There were no statistically significances difference between elevated PSQ score and oropharyngeal airway dimension (MAS, PV-A, and total airway volume). Figure 1

Figure 1

			Gender	PSQ	BMI	Adenoid	Brodsky	Space (MAS)	Vertical to A-	Total Airway Vol. (Trans+Maxillary	width/Bolton
Kendall's tau_b	Gender	Correlation Coefficient	.								
		Sig. (2-tailed)									
		N	124								
	PSQ	Correlation Coefficient	-.154**	.							
		Sig. (2-tailed)	0.044								
		N	124	124							
	BMI	Correlation Coefficient	0.018	-0.117**	.						
		Sig. (2-tailed)	0.824	0.088							
		N	108	108	108						
	Adenoid	Correlation Coefficient	0.135	0.044	-0.001**	.					
		Sig. (2-tailed)	0.108	0.536	0.993						
		N	124	124	108	124					
	Brodsky	Correlation Coefficient	0.096	0.063	-0.031	.416**	.				
		Sig. (2-tailed)	0.244	0.366	0.673	0.000					
		N	124	124	108	124	124				
	Min Airway Space (MAS)	Correlation Coefficient	-.189*	-0.110	.133*	-.340**	-.309**	.			
		Sig. (2-tailed)	0.011	0.082	0.046	0.000	0.000				
		N	123	123	107	123	123	123			
	PV - A (Porion Vertical to A-Point)	Correlation Coefficient	-.178*	0.026	0.120	-.149*	-0.014	.171**	.		
		Sig. (2-tailed)	0.016	0.675	0.069	0.030	0.833	0.055			
		N	124	124	108	124	124	123	124		
	Oropharynx? Total Airway Vol (cc) can change depending on at position	Correlation Coefficient	-0.133	-0.079	.149*	-.265**	-.303**	.553**	.182**	.	
		Sig. (2-tailed)	0.078	0.216	0.028	0.000	0.000	0.000	0.003		
		N	120	120	104	120	120	120	120	120	

Figure 2

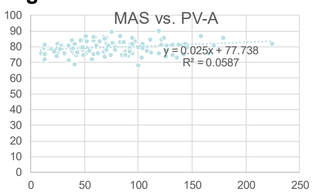


Figure 3

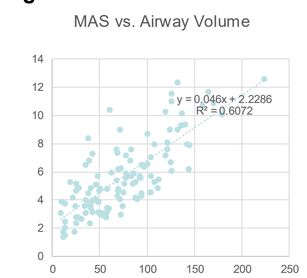


Figure 4

	Male		Female	
	mean	stdev	mean	stdev
BMI	15.57	1.32	15.71	2.17
Min Airway Space	82.05	43.77	62.35	38.33
PV-A	80.37	4.56	78.44	3.93
Oropharyngeal Total Airway Volume	5.93	2.56	5.25	2.47

Figure 5

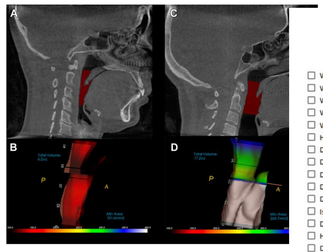
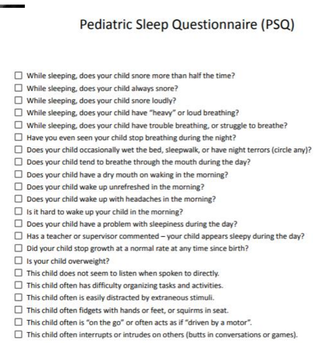


Figure 6


Pediatric Sleep Questionnaire (PSQ)

- ☐ While sleeping, does your child snore more than half the time?
- ☐ While sleeping, does your child always snore?
- ☐ While sleeping, does your child snore loudly?
- ☐ While sleeping, does your child have "heavy" or loud breathing?
- ☐ While sleeping, does your child have trouble breathing, or struggle to breathe?
- ☐ Have you even seen your child stop breathing during the night?
- ☐ Does your child occasionally wet the bed, sleepwalk, or have night terrors (circle any)?
- ☐ Does your child tend to breathe through the mouth during the day?
- ☐ Does your child have a dry mouth on waking in the morning?
- ☐ Does your child wake up unrefreshed in the morning?
- ☐ Does your child wake up with headaches in the morning?
- ☐ Is it hard to wake up your child in the morning?
- ☐ Does your child have a problem with sleepiness during the day?
- ☐ Has a teacher or supervisor commented – your child appears sleepy during the day?
- ☐ Did your child stop growth at a normal rate at any time since birth?
- ☐ Is your child overweight?
- ☐ This child does not seem to listen when spoken to directly.
- ☐ This child often has difficulty organizing tasks and activities.
- ☐ This child often is easily distracted by extraneous stimuli.
- ☐ This child often fidgets with hands or feet, or squirms in seat.
- ☐ This child often is "on the go" or often acts as if "driven by a motor".
- ☐ This child often interrupts or intrudes on others (butts in conversations or games).

DISCUSSION

There was a weak inverse correlation between PSQ scores and total airway volume. Although higher PSQ scores trended toward smaller airway volumes, total airway volume alone did not appear to be a strong predictor of elevated sleep-disordered breathing risk in this sample. Significant associations were identified between PSQ and gender, total airway volume and MAS, and MAS and PV-A. Figure 1,2,3

The lack of statistical significance may be due to several factors. The pathophysiology underlying upper airway narrowing during sleep is multifactorial. Patients with a PSQ score of ≥8 may not be associated with a clinically significant difference in oropharyngeal volume. However, a clinically meaningful difference in oropharyngeal volume may still be observed across a broader range of PSQ scores (e.g., 1 versus 9). Although the PSQ has been validated as a screening tool for sleep-disordered breathing (SBD), it may not be sufficiently sensitive or specific for assessing craniofacial morphological changes in young children.

The PSQ reflects functional and behavioral symptoms rather than direct anatomic measurements, and static CBCT imaging cannot capture dynamic airway collapse or neuromuscular tone during sleep. Additionally, total airway volume may mask localized constrictions in specific subregions (e.g., retropalatal or retroglossal areas), and variability in positioning, respiratory phase, and pediatric growth patterns may have influenced measurements. While the observed negative trend aligns with theoretical expectations, airway volume alone appears insufficient as a standalone screening marker. These findings support combining symptom-based tools with comprehensive clinical and radiographic evaluation. Future studies incorporating dynamic imaging such as MRI, subregional airway analysis, or longitudinal designs may further clarify the relationship between symptom severity and three-dimensional airway morphology. Moreover, comparisons between patients with low PSQ scores and those with high PSQ scores may help determine whether significant differences in oropharyngeal volume exist.

CONCLUSIONS

1. A correlation between elevated PSQ scores and reduced oropharyngeal dimensions measured by MAS, PV-A, and oropharyngeal total airway volume was unable to be determined.
2. Total airway volume measured from CBCT imaging is a reliable way to evaluate pediatric patient's airway.
3. PSQ might not be a reliable tool to predict reduced oropharyngeal dimensions.