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Cone-Beam Computed Tomography (CBCT) Evaluation of Intermolar and Intercanine Widths in 4-6 year old Children and their Association with Pediatric Sleep Questionnaire (PSQ) Scores

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OBJECTIVES

1. To evaluate elevated Pediatric Sleep Questionnaire (PSQ) Scores with primary intermolar and intercanine widths on Cone-Beam Computed Tomography (CBCT) scans of 4–6 year-old children at Beyond Pediatric Dentistry (Dallas, TX).
2. To investigate whether an association exists between an increased risk of airway-related disturbances with decreased dental arch widths.

BACKGROUND

Sleep disordered breathing (SDB) in non-syndromic children is associated with disruption to craniofacial and occlusal growth and development, neurocognitive and behavior deficits, and other health related conditions [5]. Adenotonsillar hypertrophy has been identified as the most common etiological factor for OSA in children. Other risk factors include reduced nasal ventilation, deviated septum, allergic rhinitis, asthma, tobacco exposure, and obesity. Chronic nasal congestion and mouth breathing can affect normal craniofacial and dentoalveolar growth and development in young children. When untreated, this can lead to longer anterior facial height and mandibular retrognathia [3,4]. Studies have shown additional findings including narrower maxillary widths, shorter mandibular arch lengths, large overjet, and Class II skeletal malocclusion with and without a higher palatal vault [2]. More recent studies have shown no correlation between SDB and occlusal characteristics in children [1].

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MATERIALS AND METHODS

This IRB-approved retrospective cohort study which was conducted from January 1, 2024 to August 31, 2025 on patients who received a limited airway assessment by a single calibrated practitioner at Beyond Pediatric Dentistry. 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). Patients underwent diagnostic CBCT imaging where minimum airway space and intermolar width measurements were obtained by a single board-certified Oral and Maxillofacial Radiologist for consistent measurements and interpretation, while intercanine width measurements were obtained by a single calibrated practitioner to eliminate variability in methods.

Inclusion criteria were age (4-6 years old), ≥ 36 weeks of gestational age, healthy or well-controlled medical conditions, and completed limited airway assessment and diagnostic CBCT. Exclusion criteria consisted of previous tonsillectomy and/or adenoidectomy (T&A), craniofacial syndrome, prior orofacial myofunctional therapy, uncontrolled medical condition, or prematurity (< 36 weeks of gestational age). Variables included age, gender, medical history, PSQ score, Body Mass Index (BMI), Adenoid, Brodsky, Minimum Airway Space (MAS), intermolar width of primary molars (IM), and intercanine width (IC). 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.

RESULTS

- 124 patients met the selection criteria.
- The average of intermolar width in males was 27.78 and in females was 26.82.
- The average intercanine width in males was 26.64 and in females was 27.75.
- There was no correlation between an increased PSQ and intermolar or intercanine width in males or females.

Table 1

	M		F	
	mean	stdev	mean	stdev
BMI	15.57	1.32	15.71	2.17
IM	27.78	2.41	26.82	2.83
IC	28.64	2.3	27.75	2.19

Table 1. Females showed minimally increased average BMI (15.71%) compared to males (15.57%). Males were found to have larger average intermolar and intercanine widths (27.78 mm ±2.41, 28.64 mm±2.3) compared to females (26.82 mm ± 2.83 and 27.75 mm ± 2.19).

Table 2

			Gender	PSQ	BMI	Adenoid	Brodsky	MAS	IM	IC
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				
		N	124	124	108	124	124			
	IM (TransvMaxillar	Correlation Coefficient	-.155*	0.107	0.041	0.067	0.082	-0.023	--	
		Sig. (2-tailed)	0.037	0.089	0.539	0.332	0.226	0.702		
		N	124	124	108	124	124	123	124	
	IC (intercanine wid	Correlation Coefficient	-0.139	0.084	0.047	0.021	0.015	0.022	.505**	--
		Sig. (2-tailed)	0.078	0.208	0.5	0.778	0.836	0.729	0.00	
		N	124	124	108	124	124	123	124	124

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

The highlighted p-values show a statistically significant correlation between the two parameters.

Table 2. In 124 patients, non-parametric analysis of paired variables used Kendall's Tau-B correlation found no correlation between PSQ and Gender (correlation coefficient = -0.154, p-value = 0.044), no correlation between IM and Gender (correlation coefficient = -0.155, p-value = 0.037), and a positive correlation between IM and IC width (0.00).

DISCUSSION

Transverse maxillary molar widths were not associated with gender, and a positive correlation was found between intermolar and intercanine widths which is reasonable to understand that changes in arch dimensions affect both variables similarly.

The limitations of the study examined two occlusal variables within a limited airway exam. However, perhaps the correlation of elevated PSQ scores could be studied with occlusal and anatomical airway variables at a slightly older age bracket (i.e. 6-8 year olds), or elevated PSQ scores compared with gold standard of polysomnography (PSG) results for obstructive sleep apnea (OSA) diagnosis.

Prevention of continued SBD patterns is actively recognized by pediatric dentists. Screening using the PSQ, clinical exams, and airway obstruction can be duplicated with an expanded range of variables and population size in future studies. Success is also dependent on managing variability between providers obtaining measurements and interpreting data. PSQ scores may be a useful tool for assessing a child's sleep habits, but it does not correlate with morphological variances used in this study. Future studies should include intermolar and intercanine widths in patients a PSQ score < 8.

Early identification and screening of signs and symptoms of SDB can facilitate referrals to medical specialists (e.g. pediatricians, allergists, neurologists, otolaryngologists and sleep medicine physicians) for proper diagnosis. Also, referral to other specialists (e.g. pediatric dentists, orthodontists, and myofunctional therapists) can facilitate adjunct therapies. Pediatric dentists are well-positioned to provide comprehensive early occlusal evaluation and identification in children at high risk for SDB [6].

CONCLUSIONS

1. There was no significant correlation between PSQ scores > 8 with and gender nor intermolar width and gender.
2. A positive correlation was statistically relevant between intermolar and intercanine widths.