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Original Article

The preliminary results of the differences in craniofacial and airway morphology between preterm and full-term children with obstructive sleep apnea

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Abstract *Background/purpose:* The prematurely born and obstructive sleep apnea (OSA) could affect craniofacial and airway growth. The purpose of this study is to compare the differences in craniofacial and airway morphology between preterm and full-term children both with OSA problem.

Materials and methods: The differences in craniofacial and airway morphology between preterm children and full-term children both with OSA problem during the prepubertal (age 6–10) and pubertal (age 11–14) period were measured using lateral cephalometric radiograph.

Results: In the prepubertal period, effective maxillary length, and length from Go to Gn were smaller in the preterm group ($n = 6$) compared to the full-term ($n = 8$). The length of the soft palate was smaller and the distance soft palate-posterior side of nasopharynx was longer in preterm children. During puberty, (1) position of maxilla relative to cranial base: there was an anteroposterior maxilla and a mandibular discrepancy, a convexity of facial profile, (2) the distance from point A to nasion perpendicular, the distance from Pog to nasion

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perpendicular, and the ratio of effective maxillary length/effective mandibular length were smaller in the preterm group ($n = 5$) compare to the full-term ($n = 6$).

Conclusion: During prepuberty, the preterm children had a significantly shorter effective maxillary and mandibular length but the catch up growth resulted during the pubertal period in reduction in facial profile convexity and more important mandibular vertical growth toward a dolichocephalic profile. Due to preterm birth, OSA children have a different craniofacial morphology compared to the full-term. When using an oral device for passive myofunctional therapy, the treatment outcome maybe different.

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Introduction

Pediatric sleep-disordered-breathing (SDB) is a common health problem in children and adolescents,^{1–3} which includes upper airway resistance syndrome (UARS) and obstructive sleep apnea syndrome (OSA). OSA is the most prevalent clinical syndrome when considering SDB.⁴ OSA may have a very negative impact on children's systemic health and development.^{3,5,6} The pathophysiology of pediatric OSA is unclear, but craniofacial anomalies and abnormal anatomic development have been reported: Nasal obstruction with retrognathism and deformities of craniofacial structures, micrognathia, short and narrow cranial base, midfacial hypoplasia, macroglossia and hypotonia are all highly associated with pediatric OSA.^{7–10} Preterm children have both a 70% incidence of OSA and a high rate of craniofacial anomalies such as shorter anterior cranial base, less convex skeletal profile, shorter maxillary length, oral defects such as high and narrow hard palate and dental arch, and significant growth failure compared to full-term children.^{11–18} Most premature infants will have "catch-up growth" during adolescence, however.^{13,16,19,20} Even though the incidence of OSA in preterm children is high, no associated study has investigated whether the craniofacial anomalies seen in premature children may relate to the incidence of OSA and the craniofacial change noted during the pubertal period.

The purpose of this study was to compare the differences in craniofacial and airway morphology between preterm children and full-term children both with OSA problems during the pre-pubertal and pubertal periods.

Materials and methods

The study protocol was approved by the Institutional Review Board (IRB 104-9308A3) of the Human Investigation Committee of Chang Gung Memorial Hospital and Chang Gung University. This study included 25 children with pediatric OSA (mean age, 9.8 ± 2.5 years; age range, 6–14 years; Table 1) diagnosed with OSA based on the results of polysomnography (PSG) in the Sleep Center at the Medical Center in northern Taiwan. The selection criteria obtained from the PSG results were as follows: (1) oxygen level in children: $<94\%$ during sleep; (2) Respiratory Disturbance Index [including apnea-hypopnea and respiratory-event-related-arousals] (RDI): ≥ 5 events/hr; and (3) Apnea-Hypopnea Index (AHI): ≥ 1 events/hr. Children were divided into two groups with two different ages (pre-pubertal {age 6–10} and pubertal {age 11–14}), and, based on their gestational ages, in "preterm" (less than 37 weeks) and "full-term". Children with epilepsy, head injury, severe developmental delay and mental retardation, schizophrenia, severe depression, and with in-ability to cooperate with the PSG-testing were excluded.

Table 1 Demographics of the subjects.

	Full-term (N = 14)	Preterm (N = 11)	Total (N = 25)	P-value
Sex, n				
Boys	12 (85.7%)	9 (81.8%)	21 (84%)	
Girls	2 (14.3%)	2 (18.2%)	4 (16%)	0.070 ^a
Age (y)	9.7 ± 2.2	9.9 ± 3.0	9.8 ± 2.5	0.825 ^b
Gestational age (week)	39.2 ± 1.3	33.7 ± 3.3	36.8 ± 3.7	$<0.001^{b,*}$
Birth body weight (gm)	3432.9 ± 657.8	2292.5 ± 934.8	2931.1 ± 965.5	0.003 ^{b,*}
Body weight (kg)	39.6 ± 20.4	37.0 ± 22.1	38.4 ± 20.7	0.529 ^b
Body height (cm)	134.5 ± 17.7	135.0 ± 19.8	134.7 ± 18.2	0.978 ^b
AHI	4.9 ± 5.5	4.3 ± 5.0	4.7 ± 5.2	0.622 ^b
RDI	7.6 ± 6.4	7.0 ± 8.7	7.4 ± 7.2	0.636 ^b

All data are listed as means and standard deviations.

^a Chi-square test.

^b Mann–Whitney test; *P < 0.05.

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