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ORIGINAL RESEARCH

The Association of Tonsil Hypertrophy with Pediatric Dentofacial Development: Evidence from a Cross-Sectional Study of Young Children in Shanghai, China

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Purpose: The prevalence of dentofacial deformity was reportedly higher than decades ago, to which upper airway (UA) obstruction-induced sleep-disordered breathing (SDB) might contribute a lot. Tonsil hypertrophy appears relatively common in the population of young children. Given that the association between tonsil hypertrophy and pediatric dentofacial deformity remained controversial, this cross-sectional research was designed to explore the internal relationship of those among young children in Shanghai, China.

Patients and Methods: A stratified cluster sampling procedure was adopted, and a representative sample of 715 young children (8–10 years old) was recruited. The OSA-18 quality-of-life questionnaires (OSA-18) were finished by their guardians, and well-trained orthodontists performed the oral examinations. After collecting the valuable information, the descriptions and analyses were run by statistical software (SPSS, version 26.0).

Results: 715 participants (334 boys and 381 girls) were involved in the analyses. As calculated, the current prevalence of malocclusion identified by Angle's classification was 45.6% in this sample. No evident relation between OSA-18 scores and dentofacial abnormalities ($P > 0.05$) was found. With the enlargement of tonsil size, the proportion of children with triangular dental arch form ($P < 0.05$) and high vault palate ($P < 0.001$) was increasingly higher. More children with protruding profiles and fewer upright profiles were observed as the tonsil size increased, although it did not show a statistical difference ($P = 0.103$).

Conclusion: Dental and craniofacial growth deficiency has become more prevalent among children, demanding more concerns from health authorities. Tonsil hypertrophy plays an essential role in the direction of dentofacial development. More efforts from local health authorities should be made to enhance public propaganda and education on the prevention and interruption of tonsil hypertrophy and related dentofacial abnormalities.

Keywords: dentofacial growth, malocclusion, tonsil enlargement, sleep-disordered breathing, OSA-18

Introduction

The prevalence of dentofacial deformity among the Chinese population of children and adolescents, as is reported, has increased by 27% from the 1960s to the 21st century, which not only deteriorates oral function but also compromises psychological state.[1,2] Among multiple complex factors, upper airway (UA) obstruction is one of the most common

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pathologies threatening pediatric dentofacial growth,[3] attributed to anatomical factors like tonsil enlargement, adenoid hypertrophy, and nasal obstruction.[4]

Chronic airway obstruction possibly induces long-term sleep-disordered breathing (SDB) behaviors like mouth-breathing, snoring, and the most severe form of obstructive sleep apnea (OSA). If left ignored, long-term SDB might cause morbid behavioral disturbances, neurocognitive dysfunction, and even higher expression of inflammatory mediators throughout the whole system.[5,6] Also, alterations in the tongue's position and posture of the head and neck may break the balance of oral and peri-oral muscles during mouth-breathing, consequently negatively impacting the pattern of morphological growth according to Moss's theory.[7] These children tend to develop a more retrusive mandible, less pronounced nose, integrated with occlusion and dental arch abnormalities.[8]

Almost 65% of children with habitual mouth-breathing suffered from tonsil and adenoid enlargement, as reported by a cross-sectional study on 114 children.[9] The role that tonsil enlargement plays in the process of dentofacial growth has been previously discussed within the orthodontic field and yet remained controversial. In 1987, Behlfelt et al conducted research on a sample of 73 children with enlarged tonsils in Sweden. It was figured out later that these children might tend to be afflicted with functional or morphological disorders such as short dental arches and crossbite, statistically correlated with narrow nasopharyngeal airways.[10] The positive relationship between sagittal cephalometric abnormalities and tonsil grades was also confirmed.[11,12] A majority of scholars and researchers obtained similar conclusions that tonsil hypertrophy might be one of the risk factors for dentofacial abnormalities.[13,14] Different voices, however, also emerged. Deana and his coworkers carried out an observable cross-sectional study among children from 6 to 12 years old and found no correlation between the grades of palatal tonsil and dental arch-related parameters.[15]

To our best knowledge, related literature on the Chinese population of children was rare. Our cross-sectional study aimed to estimate the prevalence of dentofacial abnormalities and clarify the association of tonsil grades with dentofacial growth characteristics based on a sample of Chinese children aged about 9 years old in Shanghai. Given the frequent occurrence of pediatric dentofacial abnormalities these years, we tried to explore the connection between tonsil hypertrophy and dentofacial abnormalities among Chinese children in Shanghai, hoping to adopt intervention in the earlier stage.

Materials and Methods

Design and Participants

This cross-sectional study was conducted from March to June 2019 in Shanghai, China. A stratified-cluster sampling procedure was adopted, and a representative sample of the primary students of the fourth grade was enrolled. Briefly, two districts in the urban and rural areas in Shanghai were randomly selected. Three primary schools in every district were subsequently obtained, and two classes from the fourth grade were randomly selected. Students (mean age: 9.3 ± 0.4 years) in these classes were identified as participants in the survey. Students with tooth agenesis, any congenital disorders or diseases, and lower behavior management abilities were excluded from the study. Informed consents were obtained from all participants and their guardians, which has been approved by the Ethical Committee of the Shanghai Stomatological Hospital (2016-0007). We conducted this research in compliance with the Declaration of Helsinki.

Methods

OSA-18 Survey

OSA-18 is a specific questionnaire to classify the life quality of children with OSA risk. Compared to polysomnography (PSG), OSA-18 is more comfortable and affordable for families, concise, and suitable for large-scale epidemiological investigations. This questionnaire was chosen in our work to help the orthodontists to evaluate the OSA risk and help guardians to realize the OSA impact more comprehensively. In our research, the OSA-18 questionnaire was modified, consisting of 5 parts and 20 items (sleep disturbance, physical suffering, emotional distress, daytime problems, and caregiver concerns).[16] The response categories were set from 1 (rare) to 7 (always) to reflect the frequency and severity of OSA-related symptoms like snoring. The total scores were calculated to be 140. OSA-18 applied in this study was the Mandarin version,[17] and all guardians of the children were asked to finish the questionnaires.

Oral Examination

Oral examinations were conducted by three trained and certified orthodontists. Meanwhile, the data was collected and recorded by assistants according to a standard form. The inter-examiner reliability was ensured by Cohen's kappa coefficient (value > 0.8). The examination generally required lateral profile, intra-oral, and occlusion parts. As follows, some essential items were described in detail.

According to the literature, tonsil size was graded from I to IV,[18] implying tonsils were hidden within pillars, extending to pillars, beyond pillars but not to the midline, and extending to the midline.

The dentofacial abnormalities in the present study were qualitatively evaluated, including lateral profile, molar occlusion, dental arch, and palatal depth. The lateral profile was divided into upright, protruding, and concave types. Molar occlusions were collected considering the relationship between the upper and lower first permanent molars; Angle's classes I (neutral), II (distoclusion), and III (mesioclusion) were recorded. Dental arch forms were recorded as triangular form, U-shape, and square shape. Palatal depth was assessed as a normal or high vault. Within our dentistry examination, overjet, overbite, and crossbite of anterior teeth, maxillary/mandibular crowding, and space were also carefully recorded.

Statistical Analysis

The analyses were performed by commercially available statistical software (SPSS, version 26.0). The significant difference was statistically assumed as both-sided P < 0.05.

Homogeneity and the normality of variances were analyzed by Levene's test and Shapiro–Wilk test. The distributions of continuous variables were summarized as mean ± standard deviation (M ± SD). The analyses of continuous variables according to gender were carried out by Student's *t*-test or Mann–Whitney *U*-test, including age, height, weight, and scores of OSA-18. Categorical variables were described by absolute frequencies and percentages. The chi-squared test was applied to determine the statistical associations among the dentofacial development variables according to gender, tonsil size, and total OSA-18 scores. Further analyses of the various items in the OSA-18 questionnaire according to tonsil size were performed using the Spearman rank correlation test to determine the strength of association.

Results

Among the 863 students from the 24 classes, 776 families agreed to participate in the survey, and 734 completed the oral examination after the exclusion of samples based on the criteria. After excluding data with apparent errors, 715 participants were involved in the result analyses, including 334 boys and 381 girls aged 8–10 years old (mean age: 9.3 ± 0.4 years). The general physiological features are presented in Table 1. Males were significantly different from females in height and weight (P < 0.05). Body mass index (BMI) was similar regardless of gender (P = 0.118). Besides, males got higher OSA-18 total scores (40.8 ± 11.9) than females (38.8 ± 11.7, P < 0.05).

The associations between the scores of the OSA-18 and tonsil status are displayed in Table 2. Tonsil grades were found significantly different in the items of sleep disturbance (P < 0.001), physical suffering (P = 0.003) and total scores

Table 1 Distributions of General Physical Characterizations Between Genders

	Total (N = 715)	Gender		P
		Boys (N = 334)	Girls (N = 381)	
Age	9.3 ± 0.4	9.4 ± 0.4	9.3 ± 0.4	0.235
Height	138.4 ± 8.1	139.8 ± 8.2	137.1 ± 7.5	<0.001**
Body weight	33.9 ± 8.4	35.5 ± 8.1	32.5 ± 8.1	<0.001**
BMI	16.5 ± 5.5	16.9 ± 5.8	16.2 ± 5.3	0.118
Score of OSA-18	39.8 ± 11.8	40.8 ± 11.9	38.8 ± 11.7	0.018*

Note: *Statistically significant at P < 0.05; **Statistically significant at P < 0.01.
Abbreviations: BMI, Body mass index; OSA-18, obstructive sleep apnea-18.

(P = 0.002). The children with normal tonsil sizes obtained scores of 38.5 ± 11.8, while children with obstructive tonsil sizes (grade III and IV) got average scores of 41.4 and 42.4, respectively (P = 0.002).

The distributions of different dentofacial growth variables were described and analyzed in detail in Table 3. Of those comparisons, mandibular crowding (P = 0.019) and maxillary dentition space (P = 0.045) presented a statistical difference between genders. In the analysis of OSA-18 scores, the average of this sample was calculated to be 39.8 (95% CI, 28.0–51.6). Thus, we roughly classify them into three ranks (<30, 30–45, >45) and explored the associations between OSA-18 scores and dentofacial abnormalities using the chi-square tests (Table 4) and Spearman correlation analyses (data not shown), but no correlations were found.

We explored the associations between tonsil status and dentofacial abnormalities (Table 5). With the increase in tonsil size, the proportion of children with triangular dental arch form (P < 0.05) and high vault palate (P < 0.001) was increasingly higher. An increasing number of children with protruding profiles and fewer upright profiles were observed as tonsil size increased, although it did not show a statistical difference (P = 0.103). As for the molar relationship identified by Angle's classification, no correlations to the tonsil size were discovered. We also explored the associations between tonsil size and anterior overbite, overjet and crossbite, and maxillary/mandibular crowding and spacing using Spearman correlation analyses, but no statistical correlation was detected (data not shown).

Discussion

Dentofacial development is a complex biological process that could be affected and remodeled by various risk factors breaking the balance. Our team adopted a stringent sampling design and standard protocols for the Chinese version of the OSA-18 questionnaire and oral examination. The cross-sectional research provided an accurate prevalence of dentofacial abnormalities in the young children population of Shanghai and compared several risk factors, including tonsil hypertrophy and SDB issues.

The current prevalence of malocclusion in mixed dentition (Table 3, 45.3%) appeared higher in comparison with the comprehensive investigation of Chinese children (35.42%) in 2002,[2] but matched with the estimated overall prevalence of malocclusion in Chinese school children from 1991 to 2018 (47.92%).[19] A higher prevalence of overjet, overbite, and crossbite could be observed compared to the literature.[19] Occlusion in mixed dentition was not stable due to incomplete eruption, and this malocclusion would be spontaneously corrected with the growth of the mandible.[20] Also, it might be attributed to the discrepancy of age, geography, race, time among selected samples, methodological diversity, and publication bias. It has been universally acknowledged that the prevalence of dentofacial deformity increased over the years in children, requiring comprehensive epidemiological researches and proactive interventions.

PSG is a golden standard decisive in the diagnosis of OSA. Speaking of the OSA-18, it was disputable whether OSA-18 could be regarded as one of the reliable predictors for OSA apart from PSG evaluation. Some supported the idea[21] but

Table 2 Spearman's Rank Correlation Coefficient Between Tonsil Size and OSA-18 Questionnaire

	Total	Tonsil Size				Rho	P
		I	II	III	IV		
		(N = 341, 47.8%)	(N = 197, 27.6%)	(N = 146, 20.5%)	(N = 29, 4.1%)		
Sleep disturbance	6.5 ± 2.1	6.2 ± 2.1	6.7 ± 2.0	6.9 ± 2.2	7.4 ± 2.5	0.17	<0.001**
Physical suffering	8.3 ± 3.0	8.0 ± 2.9	8.4 ± 2.8	8.6 ± 3.2	9.5 ± 3.5	0.11	0.003**
Emotional distress	8.0 ± 3.3	7.8 ± 3.1	8.1 ± 3.3	8.5 ± 3.5	8.1 ± 3.3	0.07	0.059
Daytime problems	9.1 ± 3.8	8.8 ± 3.5	9.2 ± 3.9	9.6 ± 4.3	8.8 ± 4.4	0.65	0.083
Caregiver concerns	7.9 ± 3.8	7.7 ± 3.7	8.1 ± 4.0	7.8 ± 3.9	8.6 ± 3.8	0.05	0.158
Total OSA-18 score	39.8 ± 11.9	38.5 ± 11.8	40.5 ± 11.9	41.4 ± 11.9	42.4 ± 10.5	0.12	0.002**

Note: **Statistically significant at P < 0.01.

Table 3 Distributions of Various Dentofacial Growth Variables Between Genders

		Total	Gender		P
			Boys	Girls	
Profile	Upright Concave Protruding	453 (63.4%) 24 (3.4%) 238 (33.3%)	224 (31.3%) 10 (1.4%) 100 (14.0%)	229 (32.0%) 14 (2.0%) 138 (19.3%)	0.156
Molar occlusion	Neutral Distoclusion Mesioclusion	391 (54.7%) 286 (40.0%) 38 (5.3%)	185 (25.9%) 131 (18.3%) 18 (2.5%)	206 (28.8%) 115 (21.7%) 20 (2.8%)	0.924
Anterior overjet	0–3 mm 3–5 mm 5–8 mm >8 mm	344 (48.6%) 266 (37.6%) 80 (11.3%) 18 (2.5%)	152 (21.5%) 125 (17.7%) 40 (5.6%) 13 (1.8%)	192 (27.1%) 141 (19.9%) 40 (5.6%) 5 (0.7%)	0.114
Anterior overbite	< 1/3 crown 1/3–2/3 crown 2/3–1 crown > full crown	269 (38.0%) 277 (39.2%) 121 (17.1%) 40 (5.7%)	113 (16.0%) 133 (18.8%) 63 (8.9%) 21 (3.0%)	156 (22.1%) 144 (20.4%) 58 (8.2%) 19 (2.7%)	0.211
Anterior openbite	0 mm <3 mm 3–5 mm	687 (97.3%) 14 (2.0%) 5 (0.7%)	325 (46.0%) 6 (0.8%) 1 (0.1%)	362 (51.3%) 8 (1.1%) 4 (0.6%)	0.453
Anterior crossbite	Absent Present	601 (84.8%) 108 (15.2%)	284 (40.1%) 48 (6.8%)	317 (44.7%) 60 (8.5%)	0.590
Maxillary crowding	0 mm 0–2 mm 2–4 mm 4–8 mm >8 mm	57 (8.0%) 367 (51.3%) 177 (24.8%) 92 (12.9%) 22 (3.1%)	31 (4.3%) 176 (24.6%) 81 (11.3%) 40 (5.6%) 6 (0.8%)	26 (3.6%) 191 (26.7%) 96 (13.4%) 52 (7.3%) 16 (2.2%)	0.252
Mandibular crowding	0 mm 0–2 mm 2–4 mm 4–8 mm >8 mm	96 (13.4%) 338 (47.3%) 181 (25.3%) 86 (12.0%) 14 (2.0%)	60 (8.4%) 149 (20.8%) 83 (11.6%) 37 (5.2%) 5 (0.7%)	36 (5%) 189 (26.4%) 98 (13.7%) 49 (6.9%) 9 (1.3%)	0.019 *
Maxillary dentition space	0 mm 0–2 mm 2–4 mm >4 mm	298 (41.7%) 333 (46.6%) 65 (9.1%) 19 (2.7%)	124 (17.3%) 161 (22.5%) 38 (5.3%) 11 (15%)	174 (24.3%) 172 (24.1%) 27 (3.8%) 8 (1.1%)	0.045*
Mandibular dentition space	0 mm 0–2 mm 2–4 mm >4 mm	333 (46.6%) 348 (48.7%) 25 (3.5%) 9 (1.3%)	141 (19.7%) 173 (24.2%) 16 (2.2%) 4 (0.6%)	192 (26.9%) 175 (24.5%) 9 (1.3%) 5 (0.7%)	0.077
Arch form	Triangular shape U-shape Square shape	165 (23.3%) 440 (62.2%) 102 (14.4%)	72 (10.2%) 210 (29.7%) 50 (7.1%)	93 (13.2%) 230 (32.5%) 52 (7.4%)	0.604
Plate form	Normal High arch	576 (81.8%) 128 (18.2%)	274 (38.8%) 56 (8.0%)	302 (42.9%) 72 (10.2%)	0.433

Note: *Statistically significant at P < 0.05.

Table 4 Chi-Square Test Between Dentofacial Growth Variables and OSA-18 Grades

	Total	Total OSA-18 Scores			χ^2	P
		< 31	31–45	> 45		
		(N = 160, 22.2%)	(N = 361, 50.1%)	(N = 199, 27.6%)		
Lateral facial profile						
Upright	455 (63.2%)	110 (68.8%)	215 (59.6%)	130 (65.3%)	6.03	0.197
Concave	25 (3.5%)	5 (3.1%)	16 (4.4%)	4 (2.0%)		
Protruding	240 (33.3%)	45 (28.1%)	130 (36%)	65 (32.7%)		
Molar occlusion						
Neutral	393 (54.6%)	90 (56.3%)	195 (54%)	108 (54.3%)	2.65	0.619
Distoclusion	289 (40.1%)	59 (36.9%)	151 (41.8%)	79 (39.7%)		
Mesioclusion	38 (5.3%)	11 (6.9%)	15 (4.2%)	12 (6.0%)		
Arch form						
Triangular shape	165 (23.2%)	41 (26.1%)	87 (24.4%)	37 (18.6%)	4.22	0.377
U-shape	445 (62.5%)	91 (58%)	221 (62.1%)	133 (66.8%)		
Square shape	102 (14.3%)	25 (15.9%)	48 (13.5%)	29 (14.6%)		
Palate form						
Normal	581(81.9%)	129 (82.2%)	289 (81.0%)	163 (83.6%)	0.60	0.741
High arch	128 (18.1%)	28 (17.8%)	68 (19.0%)	32 (16.4%)		

Table 5 Chi-Square Test Between Dentofacial Growth Variables and Tonsil Size

	Total	Tonsil Size				χ^2	P
		I	II	III	IV		
		(N = 342, 47.6%)	(N = 199, 27.7%)	(N = 148, 20.6%)	(N = 29, 4%)		
Lateral facial profile							
Upright	454 (63.2%)	232 (67.8%)	124 (62.3%)	85 (57.4%)	13 (44.8%)	10.56	0.103
Concave	24 (3.3%)	11 (3.2%)	5 (2.5%)	6 (4.1%)	2 (6.9%)		
Protruding	240 (33.4%)	99 (28.9%)	70 (35.2%)	57 (38.5%)	14 (48.3%)		
Molar occlusion							
Neutral	391 (54.5%)	195 (57.0%)	100 (50.3%)	83 (56.1%)	13 (44.8%)	8.42	0.209
Distoclusion	289 (40.3%)	130 (38.0%)	92 (46.2%)	54 (36.5%)	13 (44.8%)		
Mesioclusion	38 (5.3%)	17 (5.0%)	7 (3.5%)	11 (7.4%)	3 (10.3%)		
Arch form							
Triangular shape	165 (23.2%)	72 (21.2%)	48 (24.6%)	31 (21.2%)	14 (48.3%)	15.12	0.019*
U-shape	445 (62.7%)	212 (62.4%)	120 (61.5%)	100 (68.5%)	13 (44.8%)		
Square shape	100 (14.1%)	56 (16.5%)	27 (13.8%)	15 (10.3%)	2 (6.9%)		
Palate form							
Normal	579 (81.9%)	295 (87.3%)	158 (81.0%)	112 (76.7%)	14 (50.0%)	28.56	< 0.001**
High arch	128 (18.1%)	43 (12.7%)	37 (19.0%)	34 (23.3%)	14 (50.0%)		

Note: *Statistically significant at P < 0.05; **Statistically significant at P < 0.01.

others raised their doubts as well.[22] As far as it goes, OSA-18 could be an abbreviated method of predicting pediatric OSA though further evidence was still required. It has been proved that the mandarin version of the OSA-18 was a reliable and valid instrument in an investigation of Chinese children aged 6–12.[21] In our study, no evident relationship between dentofacial growth information and OSA-18 scores was observed by our analysis (Table 4). It suggested that OSA-18, reported as an OSA-specific questionnaire, might not be applicable and practicable for predicting dentofacial abnormalities. Most orthodontics believe breathing patterns play an essential role in the process of children's growth and behaviors.[23] The craniofacial disharmony seen in the clinic could be linked to SDB or OSA among children.[24] However, the results of OSA-18 relied on subjective guardians' reports on their children. Compared with the oral quantitative examination, personal bias has been mentioned, such as parental overreporting or ignorance of some symptoms,[25] thus possibly leading to a deviated outcome.

Whether pediatric dentofacial development was associated with enlarged tonsils has been contradicted by contemporary evidence. In a cross-sectional investigation, little significant connection between malocclusion and obstructive size of tonsils was observed through analyzing the collected data of 401 children.[26] Adenotonsillar surgery, statistically at least, appeared to have no benefits for dentofacial development.[27] Mouth-breathing could add an environmental weight to the development of malocclusions. Other possible factors should also be taken into consideration when dentofacial growth was mentioned, like negative maxilla development, narrow airway and heredity. It indicated that elimination of tonsil obstruction would not necessarily lead to normal breathing patterns.[26,27] The mainstream viewpoint generally supported that tonsil status was closely linked with dental and craniofacial growth. Chinese experts have reached a consensus that tonsil hypertrophy was defined as one of the risk factors for malocclusion.[1] In the assessment of dentofacial parameters (Table 5), participants with grade IV hypertrophy of tonsils were inclined to show triangular dental arch type ($P < 0.05$) and high vault palates ($P < 0.001$). In contrast, non-obstructive tonsil enlargement would not affect the dental arch morphology and palatal depth. In addition, we could clearly figure out that the lateral profile intended to be protruding ($P = 0.103$). The proportion of malocclusion of both II and III types ($P = 0.209$) went up if tonsil size was added, although it did not show any statistical difference. Among ones with class III malocclusion in this study, children with tonsil grades III and IV (17.7%) were more likely to develop class III malocclusion than those with grades I and II (8.5%). Some researchers believed that independent tonsil hypertrophy correlated with class III malocclusion, while a higher rate of class II would be detected if combined with nasal or adenoid obstruction.[9,28] The others shared the opinion that patients with tonsil grade III and IV were more likely to develop class II malocclusion than those with I and II.[12] The mixed dentition of young children could naturally result in class II malocclusion in some cases.[29] Combining our results with current literature, we believed the severity of obstructive tonsil enlargement could be a crucial indication for SDB and dentofacial growth, requiring preventive and interceptive treatments in the early stage.

Honestly, there were some deficiencies in our research. The first limitation was the absence of cephalometric data like BNS and ANB. The lateral profile, selected as a qualitative representative of facial disharmonies, might not satisfy a more detailed quantified analysis if further studies on tonsil grades were required. Similarly, dental arch morphology was divided into three types, and it would be better if inter-canine width, inter-molar width, arch length, and perimeter were added to the research. Also, it would be better if palatal classification and tonsil grades were combined and considered in our oral examination. Furthermore, there were many other predictive methods for assessing pediatric SDB or OSA when PSG was unavailable.[30] We would like to know better whether these convenient tools could help predict the direction of dentofacial growth in the future.

Dentofacial deficiency not only impairs multiple functions but also directly connects with the quality of a child's whole life. Issues on dentofacial abnormalities induced by adenoid hypertrophy have raised more concerns than decades ago among parents and doctors in communities. However, the tonsil enlargement has not been sufficiently focused. We call for more efforts from local government and health authorities to enhance public propaganda and education on preventive and interceptive measurements for related dentofacial abnormalities. Meanwhile, further studies on tonsil-related dentofacial growth should necessarily be attached with great importance. More resources of versatile and multidisciplinary combinations could be introduced into the clinics mutually. Local joint departments of otorhinolaryngology and orthodontics in communities could be cultured and incubated.

Conclusion

Dental and craniofacial growth deficiency has become more prevalent among Chinese children than before, demanding more concerns from health authorities. The tonsil hypertrophy was significantly related to SDB issues and dentofacial development. More efforts from local health authorities should be made to enhance public propaganda and education on preventing and interrupting of tonsil hypertrophy and related dentofacial abnormalities.

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Disclosure

The authors report no conflicts of interest in this work.

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