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Tooth eruption and obesity in 12-year-old children

Hai Ming Wong [a*], Si-Min Peng [a], Yanqi Yang [a], Nigel Martyn King [b], Colman Patrick Joseph McGrath [c]

[a] *Paediatric Dentistry and Orthodontics, Faculty of Dentistry, The University of Hong Kong, Hong Kong*
[b] *Paediatric Dentistry, School of Dentistry, University of Western Australia, Perth, Australia*
[c] *Periodontology and Dental Public Health, Faculty of Dentistry, The University of Hong Kong, Hong Kong*

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Abstract *Background/purpose:* There is a need to comprehensively investigate the relationship between tooth eruption and obesity. The study aimed to investigate the relationship between erupted permanent tooth number and obesity among 12-year-old children in a population-based study.
Materials and methods: A random sample of 806 12-year-old schoolchildren in Hong Kong was recruited. Oral examinations were conducted and the eruption status of the permanent teeth was assessed. Body height, body weight, waist circumference (WC), hip circumference, and triceps skinfold thickness (TRSKF) were measured to assess the adiposity statuses [weight-height ratio (W/H) and body mass index (BMI) for general obesity; WC and waist-hip ratio (WHR) for central obesity; and TRSKF for peripheral obesity]. The relationships between erupted permanent tooth number and adiposity statuses were examined in bivariate analysis and analysis of covariance.
Results: The response rate was 82.9% ($n = 668/806$). Three hundred and forty-six (50.9%) children had 28 teeth erupted. Second molars had the highest rate of noneruption (17.5–35.8%). The mean number and standard deviation (SD) of erupted permanent tooth were 26.4 (2.4). The mean value and SD were 31.1 (6.3) for W/H, 19.8 (3.7) for BMI, 70.4 (9.4) for WC, 0.82 (0.06) for WHR, and 11.8 (4.5) for TRSKF, respectively. After accounting for sociodemographic factors, analysis of covariance identified that W/H, BMI, WC, and WHR were positively associated with the number of erupted permanent teeth ($P < 0.01$).
Conclusion: Erupted permanent tooth number was positively associated with obesity (general and central) among a population-based sample of 12-year-old children in Hong Kong.

* Corresponding author. Paediatric Dentistry and Orthodontics, Faculty of Dentistry, The University of Hong Kong, 34 Hospital Road, Sai Ying Pun, Hong Kong.
E-mail address: wonghmg@hku.hk (H.M. Wong).

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Introduction

Obesity is emerging (and some suggest established) as a global public health concern among children.[1] Obesity is also a considerable factor for developing numerous chronic diseases, such as insulin resistance, type 2 diabetes, and heart disease.

Tooth eruption is defined as "the emergence of a tooth from within its follicle in the alveolar process of the maxilla or mandible into the oral cavity".[2] The mechanism responsible for tooth eruption remains unclear, although many theories have been posed. Disturbances in timing or sequence of eruption may result in a chain of complications such as dental caries, malocclusion, and periodontal disease, and subsequently increase the associated dental and orthodontic treatment needs.[3]

Discussions on the relationship between tooth eruption and adiposity status have increased recently.[4–6] In Hong Kong, a cross-sectional study of 102 12-year-old girls found that sexual maturity was associated with body weight, height, and tooth eruption. Girls who were categorized as "early maturers" had higher mean numbers of erupted permanent canines, premolars, and second molars compared to "late maturers".[7]

There is a need to comprehensively investigate the relationship between tooth eruption and different types of adiposity (central, peripheral, and general adiposity), and preferably among a random sample of the general population including both genders. This study aimed to investigate the association between erupted permanent tooth number and adiposity (central, peripheral, and general obesity) among 12-year-old children in Hong Kong.

Materials and methods

Study population

The study was a cross-sectional oral health survey conducted from February, 2010 to March, 2010. The sampling frame was all local secondary schools in Hong Kong (all children are required to attend secondary school). No reference data can be adopted directly to calculate the sample size as no study was conducted to investigate the relationship between erupted permanent tooth number and obesity among 12-year-old Chinese children. A study from the United States found that obese children had on average 1.44 more erupted permanent teeth than nonobese children (aged 5.0–13.9 years, $n = 4,361$).[4] We would like to have a statistical power 0.90 to detect a mean difference of 1.0 erupted permanent tooth number between obese and normal weight students at a 0.05 significant level and the design effect for cluster sampling, the required sample size was around 650. With the anticipated response rate of 20%, the number of students to be recruited was computed to be around 800. A random sample of 45 secondary schools (~10% of all local secondary schools) was selected from 18 districts in Hong Kong Special Administrative Region, China according to the proportion of population of the 18 districts. The secondary schools were the primary sampling unit. Within each school, all Form 1 (equivalent to United States Grade 6) southern Chinese students born between April 1, 1997 and May 31, 1997 were invited to participate in the study. Parents/primary caregivers provided their written consent and students were asked to provide their assent. Ethics approval was obtained from the Institutional Review Board of the University of Hong Kong/Hospital Authority Hong Kong West Cluster (UW 12-140).

Data collection

Assessment of tooth eruption status

The diagnostic criterion for the assessment of an erupted tooth was when any part of the crown has perforated the oral mucosa and is visible through the oral mucosa. Radiographic assessment was not conducted. The eruption of the 28 permanent teeth (2 incisors, 1 canine, 2 premolars, and 2 molars in each quadrant of the mouth) of the participating children was assessed by two trained and calibrated examiners using an intraoral disposable mouth mirror with a built in light emitting diode source. All children were examined on a portable dental chair in their schools. Repeat assessments were conducted among 10% of randomly selected participants, with at least 10 other children examined between duplicate examinations.

Anthropometric assessments

Anthropometric assessments including: (1) body height; (2) body weight; (3) waist circumference (WC); (4) hip circumference; and (5) triceps skinfold thickness (TRSKF) were assessed by two trained and calibrated examiners using standardized methods in anthropometry.[8] Body height was recorded to the nearest 0.001 m with a stadiometer (Seca, Hamburg, Germany). Body weight was recorded in kg to the second decimal place using a self-zeroing digital scale (Tanita, Tokyo, Japan). Waist and hip circumferences were recorded to the nearest 0.1 cm with an inelastic tape. TRSKF was assessed by a skinfold caliper (Harpenden, West Sussex, UK) and recorded to the nearest 0.1 mm. The weight-height ratio (W/H) was calculated as weight in kg divided by height in m. The body mass index (BMI) was calculated as weight in kg divided by the square of height in m. The waist-hip ratio (WHR) was computed as WC divided by hip circumference in cm. Repeat assessments were conducted among 10% of participants to determine intra-examiner and interexaminer reliabilities.

Sociodemographic status

Sociodemographic information (parental highest educational attainment, family monthly income, and gender) was also obtained from the questionnaire completed by parents.

Statistical analysis

The erupted permanent tooth number was calculated at tooth level as well as student level. The erupted tooth number and anthropometric measurements (W/H, BMI, WC, WHR, and TRSKF) were presented as mean with standard deviations (SD). Intra- and interexaminer reliabilities of the assessments of erupted permanent tooth number and anthropometric measurements (W/H, BMI, WC, WHR, and TRSKF), were examined though intra- or interclass correlation coefficient (ICC). Students' weight status was categorized based on the World Health Organization's (WHO) BMI criteria 2007[9] and Hong Kong Growth Survey (HKGS) W/H criteria 1993.[10] Bivariate analysis was used to assess sociodemographic variations in erupted permanent tooth number at subject level and anthropometric measurement of adiposity (general, central, peripheral) through a two sample t test or analysis of variance (ANOVA), any association between erupted permanent tooth number and anthropometric measurement of adiposity (general, central, peripheral) through Spearman's correlation coefficient, and variations in erupted permanent tooth number among different weight status based on BMI and W/H.

Correlations between erupted tooth number and the adiposity indices were examined. Evidence of multicollinearity between adiposity indices was examined and accounted for. Associations between W/H, BMI, WC, WHR, and TRSKF and erupted permanent tooth number were examined using analysis of covariance (ANCOVA, unadjusted and adjusted) separately. The dependent variable in the multivariate analyses was erupted permanent tooth number. The independent variables were adiposity indices (W/H, BMI, WC, WHR, and TRSKF), which were treated as continuous data. The adjusted models considered sociodemographic factors (parental highest educational attainment, household monthly income and child's gender).

Statistical analysis was performed using International Business Machines Corporation (IBM) SPSS Statistics 20.0 (SPSS Inc., Chicago, IL, USA). The level of significance was set at $P < 0.05$.

Results

A sample of 806 students from the randomly selected schools were invited to participate and the response rate was 82.9% ($n = 668$). Among the 668 students, 340 (50.9%) children had 28 teeth erupted. The second molar had the highest rate of noneruption (the noneruption rate was 26.5% with a range from 17.5% to 35.8% in 4 quadrants), followed by second premolar (7.8%, ranged from 7.5% to 8.1%), canine (2.9%, ranged from 0.6% to 5.1%), first premolar (2.6%, ranged from 2.2% to 3.0%), lateral incisor (1.0%, ranged from 0.1% to 1.8%), central incisor (0.5%, ranged from 0% to 1.0%), and first molar (0.1%, ranged from 0% to 0.1%), see Table 1. The mean number and SD of erupted permanent tooth were 26.4 and 2.4, respectively. The mean values (SD) of anthropometric measurements were 31.1 (6.3) for W/H, 19.8 (3.7) for BMI, 70.4 (9.4) for WC, 0.82 (0.06) for WHR, and 11.8 (4.5) for TRSKF. The ICCs for the assessment of eruption status of permanent teeth, height, weight, WC, hip circumference, and TRSKF ranged between 0.95 and 0.99.

Table 2 shows the sociodemographic variations in erupted tooth number and anthropometric measurements of adiposity (general, central, and peripheral). Girls had more erupted permanent teeth than boys ($P < 0.01$). Boys had higher W/H ($P < 0.01$), WC ($P < 0.001$), and WHR ($P < 0.001$) than girls. No statistical difference was noted in BMI or TRSKF between boys and girls ($P > 0.05$). The lower the parents' education attainment, the higher the erupted permanent tooth number of the students ($P < 0.001$). Students whose family had lower monthly income had more permanent teeth erupted at 12 years old ($P < 0.001$). Except for TRSKF ($P < 0.05$), no statistical difference was found in anthropometric measurements of adiposity (W/H, BMI, WC, and WHR) irrespective of parents' highest education attainment ($P > 0.05$). There was no statistical difference in anthropometric measurements (W/H, BMI, WC, WHR, and TRSKF) among household monthly income ($P > 0.05$).

Table 1 Type and number of erupted permanent tooth ($n = 668$).

Tooth type	*N* (%)	Tooth type	*N* (%)
Quadrant 1		Quadrant 2	
Central incisor	668 (100.0)	Central incisor	668 (100.0)
Lateral incisor	667 (99.9)	Lateral incisor	665 (99.6)
Canine	634 (94.9)	Canine	638 (95.5)
1st premolar	648 (97.0)	1st premolar	652 (97.6)
2nd premolar	614 (91.9)	2nd premolar	618 (92.5)
1st molar	667 (99.9)	1st molar	668 (100.0)
2nd molar	429 (64.2)	2nd molar	434 (65.0)
Quadrant 4		Quadrant 3	
Central incisor	661 (99.0)	Central incisor	661 (99.0)
Lateral incisor	656 (98.2)	Lateral incisor	658 (98.5)
Canine	664 (99.4)	Canine	659 (98.7)
1st premolar	653 (97.8)	1st premolar	649 (97.2)
2nd premolar	614 (91.9)	2nd premolar	618 (92.5)
1st molar	667 (99.9)	1st molar	668 (100.0)
2nd molar	551 (82.5)	2nd molar	551 (82.5)

There were significant correlations between the erupted permanent tooth number and three types of anthropometric measurements, namely W/H ($r = 0.27$, $P < 0.01$), BMI ($r = 0.25$, $P < 0.01$), and WC ($r = 0.24$, $P < 0.01$); but no significant correlation between the erupted permanent tooth number and WHR ($r = 0.06$, $P = 0.116$) or the erupted permanent tooth number and TRSKF ($r = 0.05$, $P = 0.191$).

Approximately one-fifth (20.2%) of the children could be considered overweight and 9.9% obese according to WHO's BMI-for-age criteria; while 22.0% could be considered obese according to the HKGS W/H criteria. Overweight/obese children had 1.9 more mean erupted permanent teeth than thin children ($P < 0.001$) and had 1.0 more erupted permanent teeth than normal weight children ($P < 0.001$) according to WHO BMI criteria 2007. Similarly, obese children had 2.2 more mean erupted permanent teeth than wasting children ($P < 0.001$) and had 1.1 more erupted permanent teeth than normal weight children ($P < 0.001$) according to HKGS criteria 1993, see Table 3.

There were significant correlations between the adiposity indices, with r values ranging from 0.16 (WHR and TRSKF) to 0.97 (W/H and BMI) ($P < 0.001$), see Table 4. Thus, the five adiposity indices showed evidence of multicollinearity and were considered separately in the ANCOVA. Standardization of the adiposity indices (W/H, BMI, WC, WHR, and TRSKF) into z-scores were performed prior to the ANCOVA so as to make the unit of different adiposity indices identical.

Table 2 Sociodemographic variations in tooth number and anthropometric measurements of adiposity (general, central, and peripheral).

Variable	*n* (%)	EPT_NO		W/H		BMI		WC		WHR		TRSKF	
		Mean (SD)	P	Mean (SD)	P	Mean (SD)	P	Mean (SD)	P	Mean (SD)	P	Mean (SD)	P
Gender			0.003**		0.005**		0.077		< 0.001***		< 0.001***		0.132
Male	329 (50.4)	26.1 (2.8)		31.8 (6.7)		20.1 (3.9)		72.2 (10.1)		0.84 (0.05)		11.5 (4.7)	
Female	339 (49.6)	26.6 (2.0)		30.4 (5.9)		19.6 (3.5)		68.7 (8.3)		0.80 (0.05)		12.1 (4.2)	
Parents' highest education attainment			< 0.001***		0.265		0.245		0.138		0.274		0.030*
Primary school graduate below	47 (7.0)	26.8 (1.7)		30.4 (6.1)		19.6 (3.6)		69.7 (9.8)		0.82 (0.06)		10.4 (4.1)	
Secondary school	471 (70.5)	26.5 (2.4)		31.3 (6.3)		20.0 (3.7)		70.9 (9.4)		0.82 (0.06)		12.1 (4.5)	
Post-secondary or above	138 (20.7)	25.7 (2.9)		30.4 (6.5)		19.4 (3.9)		69.2 (9.3)		0.81 (0.05)		11.5 (4.6)	
Household monthly income			< 0.001***		0.165		0.079		0.062		0.053		0.569
< HK$ 10,000	166 (24.9)	26.7 (2.3)		30.7 (5.6)		19.6 (3.3)		70.4 (8.7)		0.82 (0.06)		11.6 (3.9)	
HK$ 10,000–HK$ 40,000	380 (56.9)	26.4 (2.3)		31.5 (6.7)		20.1 (4.0)		71.0 (9.8)		0.82 (0.06)		12.0 (4.8)	
> HK$ 40,000	98 (14.7)	25.6 (3.0)		30.3 (5.9)		19.3 (3.5)		68.5 (8.4)		0.81 (0.05)		11.7 (4.2)	

*P < 0.05.
**P < 0.01.
***P < 0.001.
BMI = body mass index; EPT_NO = erupted permanent tooth number; HK = Hong Kong; P = 2 sample *t*-test/analysis of variance; SD = standard deviation; TRSKF = triceps skinfold thickness; W/H = weight-height ratio; WC = waist circumference; WHR = waist-hip ratio.

Table 3 Differences of erupted permanent tooth number among different nutritional status according to BMI and W/H.

Weight status criteria	*n* (%)	EPT_NO	
		Mean (SD)	P
WHO BMI criteria 2007			< 0.001
Thinness (1)	22 (3.3)	25.1 (2.5)	(1) < (3)*
Normal (2)	445 (66.6)	26.1 (2.6)	(2) < (3)*
Overweight & obesity (3)	201 (30.1)	27.0 (1.8)	
HKGS W/H criteria 1993			< 0.001
Wasting (1)	12 (1.8)	25.0 (2.0)	(1) < (3)*
Normal (2)	509 (76.2)	26.1 (2.6)	(2) < (3)*
Obese (3)	147 (22.0)	27.2 (1.4)	

*P < 0.001.
BMI = body mass index; EPT_NO = erupted permanent tooth number; HKGS = Hong Kong Growth Survey; SD = standard deviation; W/H = weight-height ratio; WHO = World Health Organization.

Table 4 Spearman's correlation coefficients among five anthropometric measurements of adiposity (general, central and peripheral).

Adiposity indices	Adiposity indices				
	W/H	BMI	WC	WHR	TRSKF
W/H	—	0.97*	0.83*	0.30*	0.59*
BMI	—	—	0.81*	0.32*	0.62*
WC	—	—	—	0.67*	0.49*
WHR	—	—	—	—	0.16*
TRSKF	—	—	—	—	—

*P < 0.001.
BMI = body mass index; WC = waist circumference; W/H = weight–height ratio; WHR = waist–hip ratio; TRSKF = triceps skinfold thickness.

Unadjusted and adjusted ANCOVA models identified that erupted permanent tooth number was associated with adiposity, Table 5. In the adjusted ANCOVA models, children had 0.11, 0.17, 0.07, and 4.80 more permanent teeth erupted for every 1 unit W/H z-score, BMI z-score, WC z-score, and WHR z-score increased, respectively (Table 6).

Discussion

In this cross-sectional study, the relationship between the erupted permanent tooth number and the anthropometric measurements (W/H, BMI, WC, WHR, and TRSKF) was evaluated in a group of 12-year-old children in Hong Kong. The data comprised 668 children with an almost equal distribution according to gender. Over half of the children had 28 permanent teeth erupted. The prevalence of overweight (20.2%)/obese (9.9%) based on WHO BMI-for-age criteria[9] and prevalence of obese (22.0%) according to the HKGS weight-for-height criteria[10] are consistent with previous reports of childhood obesity in Hong Kong.[11,12]

Uniquely in this study, five adiposity indices were employed providing information on general (W/H, BMI),

Table 5 ANCOVA analyses of associations between erupted permanent tooth number and obesity (general, central, and peripheral) at 12 years old.

Variable	Unadjusted[a]			Adjusted[b]		
	Estimate Coefficient	95% CI	P	Estimate Coefficient	95% CI	P
Erupted permanent tooth number						
W/H z-score	0.11	0.01, 0.14	<0.001***	0.11	0.08, 0.14	<0.001***
BMI z-score	0.16	0.12, 0.21	<0.001***	0.17	0.12, 0.22	<0.001***
WC z-score	0.07	0.05, 0.08	<0.001***	0.07	0.05, 0.09	<0.001***
WHR z-score	3.05	−0.23, 6.32	0.068	4.80	1.37, 8.22	0.006**
TRSKF z-score	0.04	−0.01, 0.08	0.058	0.04	−0.06, 0.08	0.096

**$P < 0.01$.
***$P < 0.001$.
ANCOVA = analysis of covariance; BMI = body mass index; CI = conference interval; TRSKF = triceps skinfold thickness; W/H = weight-height ratio; WC = waist circumference; WHR = waist-hip ratio.
[a] Unadjusted: separate ANCOVA.
[b] Adjusted: adjusted for parents' highest education attainment (primary school graduate or below, secondary school, post-secondary or above), household monthly income (< HK$10,000, HK$10,000— HK$40,000, > HK$40,000; USD1 = HK$7.8), and gender.

central (WC, WHR), and peripheral (TRSKF) adiposity. Although BMI is the most common method of assessing adiposity (general adiposity) and cut-off values exist to classify the level of adiposity among children and adults, no consensus on cut-off values to classify other types of adiposity among children exists.[13] Thus all adiposity indices were considered as continuous variables in analyses in order to deliver a more integrated profile on the association with erupted permanent tooth number. The difference between different coefficients obtained with the five indicators of obesity measured in the study may relate to the measurements which represent different type of obesity (general, central, and peripheral).

Erupted permanent tooth number was positively associated with two types of adiposity (general and central) in our population. Overweight/obese children had a significantly higher erupted permanent tooth number compared to normal weight children; 0.9 according to WHO BMI criteria 2007 and 1.1 according to HKGS criteria 1993, respectively. These findings concur with the previous publications.[4–6] In addition, in adjusted ANCOVA models, children with higher adiposity index (W/H, BMI, WC, or WHR) score had more erupted permanent teeth than those with lower adiposity index score, with a range from 0.07 to 4.8 more erupted permanent tooth for every 1 unit increase in the *z*-score of the adiposity index (W/H, BMI, WC, or WHR). These findings support the claim that obese children had an accelerated dental development in terms of erupted permanent tooth number at 12 years of age.

The mechanism under the association of erupted permanent tooth number and adiposity is unclear, but some possible pathways have been suggested. Adipose tissue is a complex, functional endocrine organ which plays a part in regulating metabolic processes and hormonal responses.[14] It has been reported that expansion of adipose tissue leads to hormonal changes in the obese individuals such as increased secretion of insulin-like growth factor-1,[15] and metabolic changes such as mineral metabolism,[16] which may accelerate tooth eruption.

The findings also give clinical significance in terms of caries risk. Accelerated tooth eruption in obese children may result in increasing the caries susceptibility because the retention period of teeth in the oral cavity is longer at a certain age.[17] Thus, accelerated tooth eruption in obese children is an important factor to efficiently plan caries prevention programs in children. An adequate knowledge of factors affecting dental eruption is also essential in monitoring dental development, and diagnosing and treating malocclusion at an appropriate time in adolescents. Such knowledge is also important in anthropological studies using eruption status to estimate an individual's age for legal and forensic purposes.

In our study, we found that sociodemographic factors (parental highest educational attainment, household monthly income, and child's gender) play a role in the erupted permanent tooth number. First of all, girls had significantly more erupted permanent teeth than boys, and this concurred with the literature.[4,18] Moreover, the higher the child's parental educational attainment, the lower the mean number of erupted permanent teeth observed. Similarly, higher family monthly income was associated with lower mean number of erupted permanent teeth. This was consistent with Must and colleagues'[4] study in the United States, but in contrast with the study done by Oziegbe and colleagues,[19] who investigated the relationship between sociodemographic variables and number of erupted primary teeth in suburban Nigerian children. The phenomenon found in the present study is worthy of further in-depth research.

Limitations of this study include its cross-sectional design which can only provide evidence of an association but not a causal relationship. Twelve years old is the "final" time point for counting the "erupted number" of the teeth in an oral cavity. Although it seems that only "one tooth effect" (2^{nd} molar) on the eruption rate was captured, it is an excellent time point to see the accumulation effect on the whole process of permanent tooth eruption. Data of local factors that may have an impact on the timing of permanent tooth eruption, such as early loss of primary teeth, were not collected in this survey. Nevertheless, missing teeth due to caries or trauma were reported to be very low (< 1.5%) among 5-year-old Hong Kong children.[20] No radiograph being taken is another limitation of the present study. Radiographs can not only diagnose hypodontia, which might lead

Table 6 Relationship between erupted permanent tooth number and the significant independent variables among 12-year-olds in four final models.

Independent variables	Estimate Coefficient	S.E. (Coefficient)	P
Model 1 (R^2 = 0.116, adjusted R^2 = 0.111)			
W/H z-score	0.11	0.14	< 0.001***
Gender			
Girl	0.68	0.18	< 0.001***
Boy[a]			
Parents' highest education attainment			0.004**
> HK$ 40,000 (1)	−0.99	0.39	(1) < (3)*
HK$ 10,000-HK$ 40,000 (2)	−0.29	0.35	
< HK$ 10,000[a] (3)			
Intercept	22.9	0.57	< 0.001***
Model 2 (R^2 = 0.098, adjusted R^2 = 0.093)			
BMI z-score	0.17	0.02	< 0.001***
Gender			
Girl	0.62	0.18	0.001**
Boy[a]			
Parents' highest education attainment			0.004**
Post-secondary or above (1)	−0.973	0.40	(1) < (3)*
Secondary school (2)	−0.268	0.36	
Primary school graduate or below[#] (3)			
Intercept	23.1	0.61	< 0.001***
Model 3 (R^2 = 0.107, adjusted R^2 = 0.101)			
WC z-score	0.07	0.01	< 0.001***
Gender			
Girl	0.78	0.19	< 0.001***
Boy[a]			
Parents' highest education attainment			0.007**
Post-secondary or above (1)	−0.27	0.39	(1) < (3)*
Secondary school (2)	−0.93	0.36	
Primary school graduate or below[#] (3)			
Intercept	21.2	0.80	< 0.001***
Model 4 (R^2 = 0.044, adjusted R^2 = 0.038)			
WHR z-score	4.80	1.75	0.006**
Gender			
Girl	0.69	0.20	< 0.001***
Boy[a]			
Parents' highest education attainment			0.003**
Post-secondary or above (1)	−0.97	0.41	(1) < (3)*
Secondary school (2)	−0.22	0.37	
Primary school graduate or below[#] (3)			
Intercept	22.4	1.51	< 0.001***

BMI = body mass index; HK = Hong Kong; WC = waist circumference; W/H = weight-height ratio; WHR = waist-hip ratio.
*P < 0.05.
**P < 0.01.
***P < 0.001.
[a] Reference group.

to overestimation of the noneruption rate, but also provide some important information (growth of jaw bone, general skeletal growth status, 3rd molar status, etc.) which may have influences on the eruption of teeth. However, the influence of hypodontia in the data analysis can be ignored in the present study after we compare the noneruption rate in the present study and the prevalence of hypodontia in Hong Kong.[21] Davis[21] reviewed 1093 12-year-old southern Chinese children in Hong Kong with panoramic radiographs and found that, except for the third molars, the prevalence of hypodontia was 6.1% in boys, 7.7% in girls, and 6.9% for both genders combined. He also found that the most frequently missing tooth was the mandibular incisor, affecting over half (58.7%) of the children with hypodontia. In our study, except for the third molars, the prevalence of "not fully erupted" was 52.6% in boys, 45.7% in girls, and 49.1% for both genders combined. The most frequently unerupted teeth were secondary molars, affecting 86.1% of the children without "full eruption", whilst incisors only related with 2.7% of the "not fully erupted". Tooth eruption is a complex process with multifactorial influences which may not be fully discussed in one paper. Further studies, such as longitudinal studies, incorporated with the lab studies in a birth cohort considering different types of adiposity (and different adiposity indices) and tooth eruption, may provide more definitive evidence for a causal link between, and support or refute our claims.

In conclusion, among a community sample of 12-year-old children in Hong Kong, there was a positive association between erupted permanent tooth number and adiposity status (general and central).

Conflicts of interest

The authors have no conflicts of interest relevant to this article.

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