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Tooth eruption and obesity in 12-year-old children

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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.
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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