Association between teething and independent walking in healthy children

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Developing teeth provide a reliable indication of maturation and biological age. The objective of this study was to establish whether there is any association between the time of emergence of the first primary tooth and the time when independent walking occurs. A cross-sectional study was conducted with a sample of 206 healthy children (95 girls and 111 boys) aged 12 to 60 (mean: 29.79±0.66) months who were able to walk independently. The study was conducted using a questionnaire that was filled out by the parents. The first primary tooth emerged at 6.86±0.14 (min: 3–max: 13) months; the mean independent walking time was 12.58±2.15 (min: 8.50–max: 24.00) months. There was no correlation between the first teething and independent walking times (r=0.045, p=0.523). Factors such as breastfeeding status, intake of vitamins, walker usage and body mass index were found not to affect the time of either emergence of the first deciduous tooth or independent walking. To the best of our knowledge, this is the first paper in literature to have researched the relationship between the time of emergence of the first deciduous tooth and that of independent walking. It should be explained to parents that there is no relationship between the two in order to resolve anxiety when their child acquires a tooth but does not walk, or vice versa.

Key words: first deciduous tooth, walking time, maturity, children, eruption.

Dental and skeletal ages are based on the maturation of teeth, and both have been used in detecting chronological age in many forensic studies[1,2]. Tooth formation is a continuous process, where the developmental stages of the tooth can be sequenced and defined depending on the degree of mineralization[3]. The prenatal development and calcification of teeth demonstrate a programmed sequence of tooth development and emergence[4]. Information on tooth emergence is also used to supplement other maturity indicators in the diagnosis of certain growth disturbances[5,6]. Together with skeletal development, weight and height, dental age is a method used in the assessment of physiological age in children[7]. We conducted a cross-sectional study in healthy children to investigate whether the time of eruption of the first deciduous tooth has a relationship with the time at which independent walking occurs.

Material and Methods

Healthy children who visited the pediatric outpatient clinic at Çanakkale Onsekiz Mart University Hospital for a follow-up examination were included in this cross-sectional study. The study was conducted between March and October of 2013. During the study period, 221 healthy children who fulfilled the inclusion criteria visited the clinic. Twelve children were not included because their mothers chose that they not be enrolled, and three were excluded because their mothers could not remember some of the information needed to answer the questionnaire. As a result, 206 children (95 girls and 111 boys) were included in the

study. The inclusion criteria were as follows:

To minimize recall bias, the maximum age was 5 years and the minimum age 12 months, with the ability to walk independently. Learning to walk is one of the great achievements in human development. Babies' acquisition of their first teeth and of the ability to walk independently are very exciting and happy events for families, and this usually leads to specific memories of these incidents. Therefore, we think the recall bias of this study is low.

The child was required to have normal anthropometric measurements for his/her age and sex.

There could be no known past or current disease in the child.

Premature babies, syndromic children, twins and children with chronic illness (e.g., asthma, hypertension or diabetes mellitus, or other cardiovascular, endocrine, metabolic, neurological or inflammatory diseases) were excluded because of the possible influence on tooth eruption and walking times.

A questionnaire was developed specifically for purposes of this study. Data were collected by means of maternal interviews with a questionnaire that was composed of three parts. In the first part, questions elicited demographic information including the child's age, sex, gestational age at birth, birth weight and delivery mode. The time of eruption of the first tooth and of acquisition of the ability to walk independently were also reported by mothers. In the second part, questions concerned factors that may have influenced the timing of both the first teething and walking, including type of feeding during infancy and history of vitamin supplementation during the 0–12 month period. In the last part of the survey, anthropometric measurements at the time walking occurred were obtained from medical records and noted. Body mass index (BMI) (weight (kg)/height^2 (m^2)) and BMI percentiles were calculated. Socioeconomic status (SES) was defined as one of three levels, "high," "moderate" or "low," according to the families' perceptions. Medical students (n = 4) trained in the administration and completion of the questionnaire conducted the interviews. Neither the students nor the parents of the children knew the purpose of the study. The study was approved by the Çanakkale Onsekiz Mart University Science Ethics Committee system.

Statistical analysis

Data were analyzed using SPSS software, version 19.0. Descriptive statistics (frequencies, percentages, means and standard deviations) were used to describe groups of numerical data and the basic features of the data. The variables were investigated using visual (histograms, probability plots) and analytical (Kolmogorov-Simirnov/Shapiro-Wilk tests) methods to determine whether they were

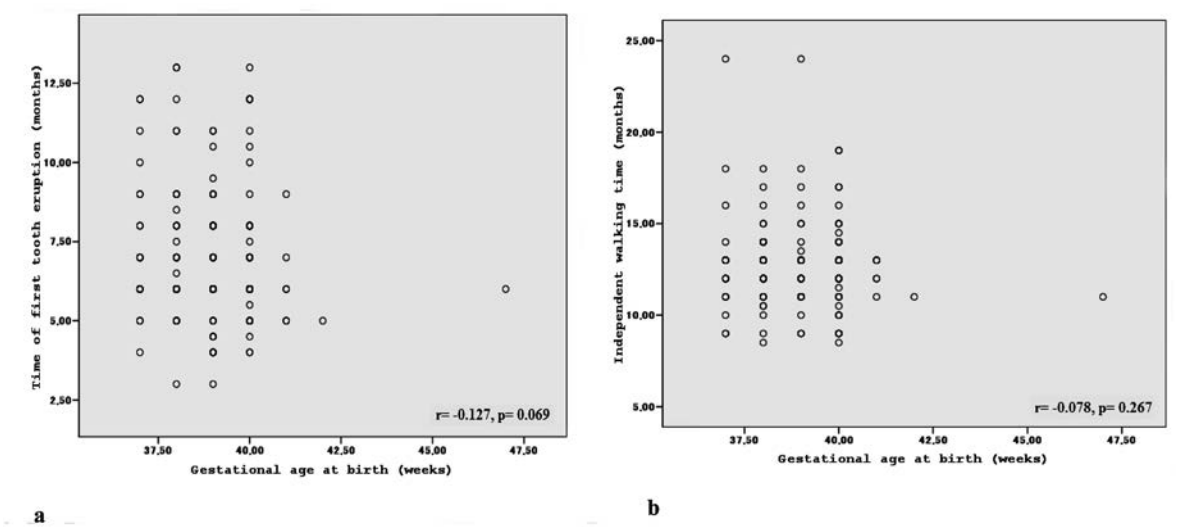

Fig. 1 (a). Correlation between time of first tooth eruption and gestational age at birth. **1(b).** Correlation between independent walking time and gestational age at birth.

normally distributed. A chi-square test was used to examine the association among categorical variables. Since the numerical variables, except for independent walking time, were distributed normally, an independent samples t-test was used to compare numerical parameters according to the gender group variable. The Mann-Whitney U test was used to compare independent walking time among the groups. The correlation coefficients and their significance were calculated using a Pearson test for normally distributed variables and a Spearman test for non-normally distributed variables. A Kruskal-Wallis test was used to compare walking time among BMI percentile groups. A P value of less than 0.05 was considered statistically significant.

Results

Table I summarizes the sample characteristics of the 206 children enrolled in the study.

Factors affecting teething

The mean duration of breastfeeding was 12.91±7.44 (min: 1, max: 30) months. There was no significant association between the first tooth eruption time and duration of breastfeeding (Pearson test, r = -0.003, p = 0.964) and no association in those who were breastfed exclusively (Pearson test, r = -0.014, p = 0.894).

Vitamin intake status of the study population during 0–12 months of age is summarized in Table II. The mean first tooth eruption time was 6.98±2.07 months in children who had

Table I. Characteristics of the Study Population

Variables	Mean±SD
Age (mo)	29.79±9.50
Female (n=95)	29.85±9.52
Male (n=111)	29.73±9.53
Gestational age at birth (weeks)	n (%)
≥37-<41	198 (96.1)
≥41	8 (3.9)
Delivery mode	n (%)
NVD	53 (25.7)
C/S	153 (74.3)
SES	n (%)
High	123 (59.7)
Moderate	76 (36.9)
Low	7 (3.4)
	Mean±SD
Birth weight (g)	3347.56±482.74
Birth height (cm)	50.28±2.19
BMI at time of walking	17.11±1.87
Feeding during infancy	Mean±SD
Duration of exclusive breastfeeding (mo)	16.96±6.50
Duration of breastfeeding (mo)[a]	12.91±7.44
Age of onset of formula intake (mo)[b]	2.72±2.42
Duration of formula intake (mo)[b]	10.51±5.88
Duration of vitamin D prophylaxis (mo)[c]	9.42±3.37
Duration of prophylactic iron supplement (mo)[d]	6.73±2.25
Duration of multivitamin intake (mo)[e]	9.75±8.22
Total number of children	206

[a] 2 children were not fed breast milk, [b] 94 children were not fed formula, [c] 38 children did not take vitamin D, [d] 74 children did not take iron supplements, [e] 137 children did not take multivitamins,
SD: Standard deviation, mo: months, C/S: Caesarean section, NVD: Normal vaginal delivery

Table II. Vitamin Intake of the Study Population during the 0–12 Month Period

Variables	n (%)
Exclusive intake of Vit D	104 (75.9)
Exclusive intake of multivitamin	5 (7.2)
Intake of both Vit D and multivitamin	64 (92.8)
Intake of neither Vit D nor multivitamin	33 (24.1)

vitamin D prophylaxis and 6.32±1.43 months in those who did not. There was no significant difference between them (p = 0.061).

Sixty-nine (33.5%) children used a multivitamin. The mean first tooth eruption time was 7.24±2.07 months in those who used a multivitamin and 6.68±1.91 months in those who did not. The difference was not statistically significant (p = 0.56).

Prophylactic iron supplementation was used in 132 (64.1%) children, with a duration of 6.72±2.25 (min: 1, max: 10) months. It was not associated with the time of teething (p = 0.147).

On the basis of birth weight, 9 children were small for their gestational age (SGA) (mean birth weight of 2408.89±109.71 g), and 18 were large for their gestational age (LGA) (mean birth weight of 4278.33±254.31 g). Mean eruption time of the first primary tooth was 6.39±1.41 months in the SGA group and 7.22±2.66 in the LGA group. There was no correlation between birth weight and first tooth eruption time (r = 0.034, p = 0.633).

There was also no correlation between gestational age at birth and first tooth eruption time or independent walking time (Fig. 1a and b). In addition, there was no correlation between birth height and first tooth eruption time (r = -0.018, p = 0.799).

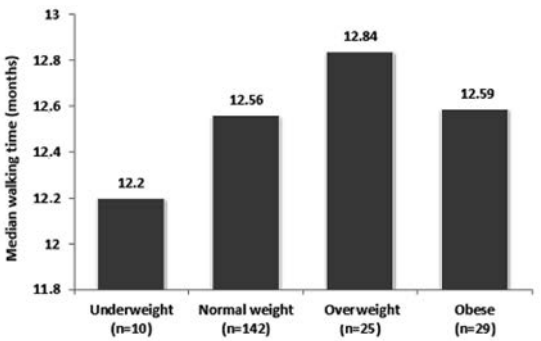

Fig. 2. BMI percentiles at time of walking.

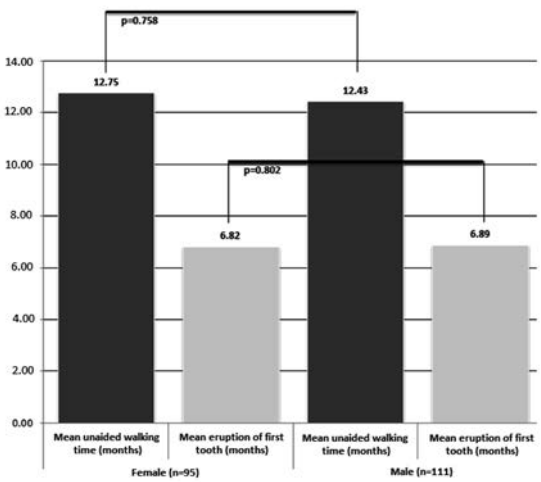

Fig. 3. Differences between genders in time of eruption of first tooth and time of independent walking.

Factors affecting walking

There was no significant relationship between independent walking time and duration of breastfeeding (Spearman's rho = 0.042, p = 0.554), and no association in those who were breastfed exclusively (Pearson test, r = -0.126, p = 0.226). Independent walking time was 12.63±2.26 months in children who had prophylactic vitamin D and 12.33±1.55 months in those who did not; there was no significant difference between them (p = 0.685). Multivitamin usage also was not associated with walking time (p = 0.965). Regarding iron prophylaxis, walking time was not significantly different in those who had it and those who did not (p = 0.742). There was no correlation between independent walking time and either birth weight or birth height

(rho = -0.062, p = 0.375, and rho = -0.033, p = 0.640, respectively). At the time when independent walking occurred, the mean height and BMI were 76.10±3.66 (min: 67, max: 90) and 16.69±0.20 (min: 12.92, max: 23.92). According to BMI percentiles, 68.93% (n = 142) of the children were of normal weight, 14.08% (n = 29) were obese, 12.14% (n = 25) were overweight and 4.85% (n = 10) were underweight. Fig. 2 shows median walking times according to BMI percentiles; there was no significant difference (p = 0.893, Kruskal-Wallis test). Seventy-seven (37.4%) children used a walker between 2 and 10 months. The mean time of walker use was 4.43±0.21 months. There was no difference in terms of independent walking time between walker users and non-users (p = 0.069).

Association between time of independent walking and eruption of first deciduous tooth

The mean independent walking time was 12.58±2.15 (min: 8.50, max: 24.00) months, and the time of eruption of the first tooth was 6.86±1.98 (min: 3.00, max: 13.00) months. There was no significant difference between girls and boys (Mann-Whitney U test, p = 0.758, and independent samples test, p = 0.802, respectively) (Fig. 3). There was no correlation between independent walking time and time of eruption of the first deciduous tooth (Spearman's rho = 0.045, p = 0.523) (Fig. 4).

Independent walking time and eruption of the first tooth were concurrent in 5 children. Walking occurred before teething in 6 children (min: 15 days, max: 60 days). In 195 children, teething took place before walking; the mean interval was 6.07 months (min: 15 days, max: 17 months).

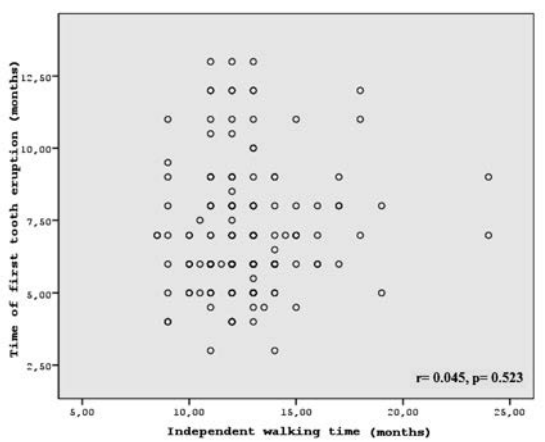

Fig. 4.Correlation between time of first tooth eruption and time of independent walking.

Discussion

In this study, no association was found between the time of eruption of the first deciduous teeth and that of independent walking. The timing of teething differs among infants. It can be very early in some babies and late in others. Similarly, the time at which independent walking occurs differs from child to child. Both events are markedly associated with hereditary factors, but some diseases, such as rickets and hypothyroidism, can affect their timing[8]. Nutritional status during infancy also affects growth and development, and malnutrition can cause delays in dental development[9]. Children with known past or current disease were excluded from this study.

Breast milk contains many components that allow for growth and development in infants[10]. Folayan et al.[11] reported that breastfeeding had no impact on the timing of eruption of the primary tooth, a finding similar to the results of our study. In a recent study, the duration of breastfeeding on the timing of the eruption of the first tooth was investigated, and no significant relationship was found, again similar to the results of our study[12].

Micronutrient deficiencies can cause a failure to thrive in childhood. Markestad et al.[13] found that breastfed children may have low levels of vitamin D without biochemical or clinical signs of rickets. Therefore, breastfed children should be given vitamin D supplementation. In this study, 81.6% of the children had vitamin D prophylaxis during the first 12 months of age; this was found to have no significant effect on independent walking time or on the eruption time of the first deciduous tooth. Iron deficiency, which can adversely affect children's growth, is the most common micronutrient deficiency worldwide[14]. From six months of age, all infants should receive a sufficient intake of iron-rich foods[15]. Kariger et al.[16] showed that iron status is a significant predictor of walking. In this study, 64.1% of the children had prophylactic iron supplementation; it was not associated with early teething or walking.

Several factors, such as length of gestational

period and gender, play a role in the timing of the eruption of primary teeth[17]. Emergence of deciduous dentition in boys is earlier than that in girls by about one month[18]. In the present study, premature babies were excluded, and the timing of the emergence of the first tooth and of independent walking were not found to be affected by gender. Contrary to our study, research has shown a correlation between greater height at birth and onset of teething[19]. Sajjadian et al.[20] found a negative correlation between birth weight and time of eruption of the first deciduous tooth, suggesting that delayed tooth eruption may be related to lower birth weight. In the present study, there was no correlation between birth weight and first tooth eruption time.

A delay in walking may simply be a variation of the normal[21]. Walking is considered to be delayed if it has not been achieved by 18 months. In this study, independent walking time for the group was between 8.5 and 24 months, with a mean of 12.58±2.15 months. Infant walkers are mobile wheeled seats that allow infants to move around with their feet on the floor, which is believed to foster the development of motor skills. Studies have shown that infants who used walkers sat, crawled and walked later than those who did not use walkers[22,23]. However, in this study, no difference was detected between walker users and non-users in terms of independent walking time. In addition, although previous studies have shown that delayed motor activity may be caused by obesity[24,25], BMI percentiles were not correlated with walking time in this study.

To our knowledge, this is the first paper to research the relationship between emergence of the first deciduous tooth and walking time. This study provides insights into the timing of teething and walking. These developmental stages are important, especially for parents, and it should be explained to them that there is no relationship between when children begin teething and when they start walking, or vice versa, to relieve any anxiety they might feel in this respect.

There are some limitations in this study. First, the research was carried out on a regional scale and may not be indicative of the situation in other parts of Turkey. Socioeconomic levels were not studied in detail during our research. Second, we assessed children's teething and unaided walking times using a questionnaire filled out by mothers, who may not have recalled these times exactly. However, babies' acquisition of their first teeth and the ability to walk independently are very exciting and happy events for families, and this usually leads to specific memories of these incidents. Therefore, we think the recall bias of this study is low.

This study may be a guide for further prospective investigations about the relationship between the time of emergence of the first tooth and that of independent walking.

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