Second Premolar Emergence and Adverse Childhood Events in US Children

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Abstract

Purpose: Early childhood adversity can accelerate biological aging, which can lead to mental and physical health challenges later in life. More biomarkers of early aging need to be identified since existing biomarkers are either difficult to detect or cannot be detected until adolescents. We hypothesized that early childhood adversity is associated with earlier second premolar emergence, which can be obtained noninvasively during routine dental care.

Methods: We used cross-sectional data from 5 consecutive cycles of the National Health and Nutrition Examination Survey (2009-2018), including ages 8-14 years old and excluding children with incomplete oral health data. Emergence prevalence was stratified by age. Associations between number of emerged second premolars and adverse childhood events (parental education, ratio of family income to poverty level, marital status, food security, and mother smoking during pregnancy) within age were tested using linear regression with appropriate survey weights. As emergence times of teeth have been shown to vary by sex, race/ethnicity, body mass index (BMI) and income.

Results: The sample had 6,410 children 8-14 years old representing over 29 million US children. Parental education, ratio of family income to poverty level, marital status, and mother smoking during pregnancy were statistically significant (p< .05) at different ages. Yet after adjusting for sex, all the adverse childhood events listed above were found to be significant.

Conclusion: Parental education has been shown for the first time to be associated with tooth emergence, specifically second premolars.

Introduction

Adverse childhood events (ACEs), like abuse, neglect, or other traumatic experiences, are known to be linked to chronic health problems, like heart disease, depression and obesity. The Center of Disease Control estimates that ACEs cause about $748 billion in health care expenses per year. Identifying children impacted by ACEs earlier would allow these children to get the services they need. Children impacted by ACEs also have a risk of advanced biological aging. Advanced biological aging is when individuals develop at a fast pace to reach adult-like capabilities, even at the cellular and molecular level. These have classically been identified in children by the timing of menarche (11–16-year-olds) or epigenetic changes, which occur later in childhood or are expensive and invasive to determine. Our previously published data show that income, also an ACE, impact children's oral development, specifically the timing of tooth emergence, earlier and with noninvasive techniques.

Objective

To determine if the timing of second premolar emergence is impacted by ACEs.

Materials & Methods

Cross-sectional data from 5 consecutive cycles of the National Health and Nutrition Examination Survey (NHANES 2009-2018)

- Ages: 8- to 14-year-olds
- Excluded: children with incomplete oral health data
- Stratified by age
- Associations tested using linear regression
- All analyses adjusted for survey weights and sex

Results

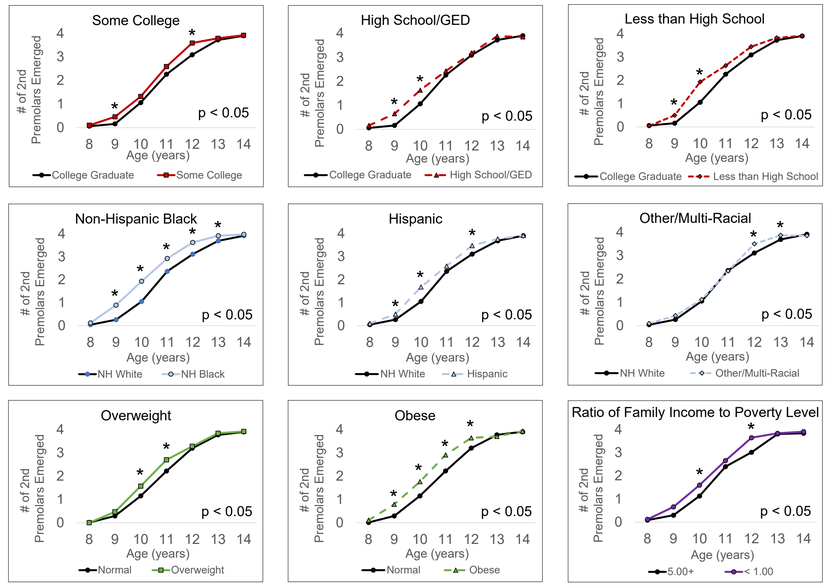
	n	% (Weighted)
Age, y (mo)		
8 (96 to 107)	1015	14.5
9 (108 to 119)	1001	14.0
10 (120 to 131)	963	13.3
11 (132 to 143)	999	14.3
12 (144 to 155)	795	14.4
13 (156 to 167)	789	14.1
14 (168 to 179)	848	15.3
Sex		
Male	3238	50.9
Female	3172	49.1
Race/Ethnicity		
Non-Hispanic White	1372	52.6
Non-Hispanic Black	1294	13.9
Non-Hispanic Asian	492	4.5
Hispanic	1619	24.0
Other/Multi-racial	350	5.1
BMI Categories		
Underweight	155	2.6
Normal	3513	56.9
Overweight	1154	18.0
Obese	1553	22.4
Analytic Sample	6410	
Represented US Population	29,110,411	

	n	% (Weighted)
Parental Education (Highest)		
Less than High School	1,154	16.1%
High School/GED	1,019	16.4%
Some College	1,620	31.7%
College Graduate	1,387	35.8%
Ratio of Family Income to Poverty Level		
< 1.00	1,866	22.2%
1 - <2.00	1,692	24.6%
2 - <5.00	1,711	36.5%
5.00+	629	16.7%
Head of Household's Marital Status		
Married/Live-in Partner	3,639	75.6%
Single/Divorced/Widowed	1,548	24.4%
Child Food Secure		
No	870	10.8%
Yes	5,451	89.2%
Mother Smoked During Pregnancy		
No	5,588	87.6%
Yes	720	12.4%

Our sample had 6,410 children ages 8-14 years old representing over 29 million US children. The number, n, and weighted percentages are shown for all categories. In the chart below are the p-values and R^2 percentages, which shows how well each ACE fits or explains the second premolar tooth emergence, in each year of age.

Adjusted for sex & survey weights	8-year-olds		9-year-olds		10-year-olds		11-year-olds		12-year-olds		13-year-olds		14-year-olds	
	p-value	R^2	p-value	R^2	p-value	R^2	p-value	R^2	p-value	R^2	p-value	R^2	p-value	R^2
Race/Ethnicity	0.167	1.08%	<0.001	5.33%	<0.001	6.77%	0.011	3.81%	0.018	2.83%	0.028	1.42%	0.033	0.47%
BMI Categories	0.037	0.95%	<0.001	5.42%	<0.001	5.88%	<0.001	6.72%	0.005	2.12%	0.402	0.56%	0.752	0.11%
Ratio of Family Income to Poverty Level	0.460	0.45%	<0.001	4.15%	0.020	4.19%	0.112	3.70%	0.001	2.77%	0.327	1.23%	0.487	0.77%
Parental Education	0.047	0.77%	<0.001	5.03%	<0.001	6.08%	0.154	3.96%	0.003	3.58%	0.224	0.67%	0.841	0.27%
Head of Household's Marital Status	0.098	0.40%	0.104	1.84%	0.017	3.12%	<0.001	4.42%	0.455	0.82%	0.863	0.02%	0.800	0.01%
Mother Smoked During Pregnancy	0.643	0.14%	0.024	2.22%	0.558	2.73%	0.150	2.63%	0.720	0.39%	0.001	0.90%	0.415	0.20%
Child Food Secure	0.774	0.16%	0.030	1.96%	0.554	2.67%	0.174	2.61%	0.145	0.57%	0.118	0.39%	0.673	0.14%

Results



We then further analyzed the impact of parental education, race/ethnicity, BMI, and the ratio of family income to poverty level on the timing of second premolar emergence in our cohort. Future research needs to analyze more traumatic ACEs and their impact on tooth emergence, as well as identifying the best teeth to analyze clinically.

Conclusions

1. Parental education has been shown for the first time to be associated with tooth emergence.
2. Pediatric dentists, as well as other dentists, can inform parents of earlier eruptions of permanent teeth using these new predictors.

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