A. Prevalence of Erosive Tooth Wear in South West San Antonio, Texas

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By

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B. ABSTRACT: Objectives: To estimate the prevalence of erosive tooth wear in children aged 12-14 years in the Southwest region of San Antonio. **Methods:** A convenience sample of 307 children aged 12-14 years was selected from two Junior High Schools. The population consisted predominantly of Hispanic Mexican Americans. A sample size of 300 provided 80% power, assuming the true prevalence of erosion was 25% as in a previous UK Child Dental Health Survey (1993) study. The US prevalence is not known. The examiner was calibrated against the lead examiner of the UK study. The Tooth Wear Index and Screening for Oral Health using ASTDD criteria were assessed. Oral health and dietary assessment questionnaires were used and included data on gender, race, parental education level, fluoride history, general oral hygiene habits and detailed dietary habits relating primarily to the consumption of acidic beverages and foods (sodas, juices, citrus fruits, Lucas, chamoy etc). **Results:** The overall prevalence of erosion was found to be 5.5% (6.3% and 4.9% in each school). All affected children showed erosive tooth wear confined to the enamel with no exposed dentin. This prevalence is lower than the 25% reported in the prior UK survey of 11 year old children. The severity is also low. No significant associations were found between erosive tooth wear and frequency of intake of groups of acidic foods and beverages using a non-validated putative food intake questionnaire (Chi-square $P<0.05$). **Conclusion:** This study indicated a low prevalence and low severity of dental erosion among children aged 12-14 in this limited geographic area. Issues of sampling and response bias preclude these finding being generalized to other populations and regions. Because the local consumption of some putative risk foods appears to be increasing, this study provides a baseline for future assessments of erosive tooth wear in this population.

C. SPECIFIC ROLES

The specific roles played by me as principal researcher was in literature review, analyzing, interpreting and reporting this study. I also participated in field planning and data collection. I was assisted by Dr Bennett Amaechi BDS, MSc, PhD (calibrated examiner for erosion), Lee Ann Zarzabal MS (consulting statistician), and Martha Baez RDH, MPH (Spanish translator).

D. STATEMENT OF THE PURPOSE OF THE PROJECT

The purpose of this study was to determine the prevalence of dental erosion in children aged 12-14 years in the Southwest region of San Antonio, and the associations thereof.

E. BACKGROUND AND REVIEW OF THE CURRENT PERTINENT LITERATURE

There has been considerable attention in recent times focused on the problems of tooth surface loss both in adults and children. Tooth wear is undoubtedly due to a combination of erosion, abrasion, and attrition; in the younger population, it is the contribution from the erosion that appears to be increasing disproportionately in some countries (1). Dental erosion has been defined as the loss of dental hard tissue due to excessive exposure to acids in combination with abrasion. It is because of these dual etiologic factors that it is now often referred to as "erosive tooth wear" (2). Dental erosion typically appears as smooth, highly-polished, scooped out areas with no evidence of chalkiness or white spots. Subjects may also vary in their susceptibility to erosion (2).

Acidic substances, either intrinsic or extrinsic in origin, can cause dental erosion. Intrinsic factors that cause oral exposure to acidic substances can involve certain medical or oral conditions like chronic vomiting, bulimia, and gastro-esophageal reflux disorders (3). Extrinsic

factors can originate from certain occupations (chef or wine taster, industrial workers involved with plating, galvanizing, and acid pickling, battery manufacturer, soft drink manufacturer, process engraving, crystal glassworks, dyestuffs, and enamel manufacture), diet (prolonged sucking on lemons, pickles, candies, soft drinks, fruit juices) and certain medications (3). Extrinsic sources of acid are many and varied. There were reports over 100 years ago, that related acidic drinks to dental erosion and the 'wasting of tooth tissue' (4).

Dental erosion is distinctly different from dental caries due to many characteristics including its formation only on non plaque accumulating surfaces, demineralization by acids of non-bacterial origin, and its combination with abrasion on smooth and occlusal surfaces resulting in an appearance often described as tooth wear (2).

There is a growing concern regarding an apparent increase in the prevalence of dental erosion, particularly in the United Kingdom (UK) and several countries in Europe. A high prevalence of erosion in adolescents and children have been reported in the UK but very little data is available in other countries including in the United States (US). From the published data of a 1993 UK survey, as well as information presented in a scientific advisory group meeting, concerning the prevalence of dental erosion, the prevalence of the condition was 52% in children aged 4-5 years of age and 25% in 11 year-olds in the UK (5). The National Diet and Nutrition Survey in UK showed 19% of the children aged between 1.5-4 years had erosion of the palatal surfaces and 10% had erosion affecting the labial surfaces (6).

The results of a limited unpublished survey of 4-5 year-old children in the US indicated a prevalence of about 25% with the prevalence inversely related to socioeconomic level (7). Other than this latter report, however there appears to be no data on the prevalence of dental erosion for the US populations.

Studies that were carried out in Europe on the potentially increasing problem of dental erosion and its multi-factorial nature also showed its possible relationship with socio-economic status and extrinsic factors (8). One such study carried out in the Netherlands showed the prevalence of visible smooth wear was 30% and that at least deep smooth enamel wear was present in 11% of 15-16 years olds. A significant effect on visible smooth wear was found for gender and social background but no significant influence was found for dietary patterns, drinking habits or oral hygiene practices in the study (9).

There have been other studies which did show the relationship of dental erosion to both socioeconomic factors and the influence of dietary intake (10, 11, and 12). A study carried out in fluoridated Birmingham showed that 48% had low severity erosion, 51% had moderate erosion and 1% had severe erosion. They concluded that there was significantly more erosion in children from low socioeconomic groups and that there was a relationship between dental erosion and acidic dietary intake (1). Studies have shown that ethnicity and age also play a vital role in the prevalence of dental erosion. A study conducted in Leicestershire showed that the Whites had more erosion than the Asian children. The prevalence of erosion was 56% in subject's aged 12 years and 64% in subjects aged of 14 years. Boys seemed to have more erosion than girls (13).

F. STUDY DESCRIPTION

The consumption of acidic soda and sports drinks is rising and the promotion and sale of acidic Mexican confectionaries is intensifying. There is a need to explore possible dental effects. Therefore, we conducted an initial study of the prevalence of dental erosion and use of putative foods. Community education about preventive factors may need to be developed, targeted and

implemented, but knowledge of these factors is lacking, and the etiology of tooth wear/erosion is presumptive in the United States at present. There is a growing concern regarding certain specific putative foods (Mexican citric acid/salt confectionaries), which are acidic in nature, and could cause harmful effects on teeth. They are increasingly promoted to Mexican Americans.

The specific aim of this study was to determine the prevalence and associations of dental erosion in children aged 12-14 years in the Southwest region of San Antonio (Single examination). Dental examinations and oral health questionnaire were performed on the children aged 12-14 years at two middle schools of Southwest Independent School District, of San Antonio. The data collection occurred in September 2003.

G. PROCEDURES AND METHODS

Parents completed an informed consent statement and parental questionnaire (medical history, demographics, oral health, dental practices and parental educational attainment) before the students received oral examination and completed a detailed dietary and oral practices questionnaire. Upon review and acceptance of the consent form and parental questionnaire, and the inclusion/ exclusion criteria, the subjects were accepted into the study. Visual dental examinations were performed using portable equipment by an examiner calibrated against the UK Child Health Survey's (1993) standard examiner. Oral soft tissue examination and dental erosion examination data were entered on the corresponding case report form (CRF). For those families without a dentist, information was given on access to private and public dental facilities. Reports to the school nurse and to all individual parents were made, indicating those children needing dental care and emphasizing those in urgent need. Information on dental erosion and its prevention accompanied these reports. In addition, some financial assistance was made available

by the study for children in need of dental treatment and without public or private insurance, through school nurses and San Antonio Metropolitan Health District Dental Clinics.

POPULATION AND SAMPLE

Demography: San Antonio is now the ninth largest city in the United States, with a population of 1,144,646 people, 405,474 households, and 280,993 families residing in the city. The population density is 1,084.4/km² (2,808.5/mi²). The racial makeup of the city is 68 % White, 7 % African American, 1 % Native American, 2 % Asian, 0.09% Pacific Islander, 19 % from other races, and 4% from two or more races. Fifty nine percent of the population is Hispanic or Latino of any race (14). Twenty nine percent are under the age of 18, 11 % between 18 and 24, 31% between 25 and 44, 19 % between 45 and 64, and 10 % who are 65 years of age or older. The median age of San Antonio population is 32 years; (15).

Selection of study population and sample size justification: Children aged 12-14 years were selected from McAuliffe and Scobee Junior High Schools of Southwest Independent School District. The specific schools and grades were selected to provide a convenience sample of 300 children in consultation with the head nurse, the superintendent and school principals, and in keeping with Inclusion/Exclusion Criteria. A sample size of 300 was needed for approximately 80% power to detect an odds ratio of 1.5, assuming the true prevalence of erosion is 25% from previous studies.

Inclusion criteria: Each subject was required to: 1) provide written informed parental consent prior to their participation; 2) be between 12-14 years of age; 3) be a resident of the surrounding areas; 4) be in good physical health (i.e., no history of a medical problem which would

contraindicate their participation in the study such as a need for pre-medication prior to dental procedures); and 5) agree to comply with responsibilities as a study participant.

Exclusion criteria: Subjects were excluded who: 1) demonstrated an inability to comply with study protocol requirements; or 2) had orthodontic appliances.

Withdrawal of subjects from the study: Subjects were encouraged to complete the study; however, subjects could withdraw from the study at any time or for any reason. The reasons for withdrawal were documented on the appropriate case report forms (CRFs).

SURVEY PARAMETERS

1) Tooth wear index 2) Screening for oral health using ASTDD Criteria (caries free, past caries, present caries, sealants present, urgent care indicated, other conditions) and 3) Oral health and dietary assessment questionnaires.

Tooth Wear Index: (Table 1) Visual examinations by the examiner, of the facial, lingual and incisal surfaces of the maxillary central and lateral incisor, and cuspids; and the occulsal surfaces of the maxillary and mandibular first molars were conducted using an examining light and a surface reflecting mirror with each tooth surface being dried with gauze. For the purposes of this assessment, the mouth was divided into segments as follows:

Upper right segment: Central Incisor, Lateral Incisor, Cuspid and First Molar

Upper left segment: Central Incisor, Lateral Incisor, Cuspid and First Molar

Lower left segment: Central Incisor, Lateral Incisor, Cuspid and First Molar

Lower right segment: Central Incisor, Lateral Incisor, Cuspid and First Molar

Each eligible tooth was assessed looking at each coronal surface. The assessment began with the upper right first maxillary molar (#3) occlusal surface, preceded to cuspid (#6) facial surface, to

the incisal surface and concluded with the lingual surface. The lateral incisor (#7) was examined next followed by the upper right central incisor (#8). Upon completion of the upper right segment, the exam proceeded to the upper left segments then the lower left and concluded with the lower right.

Guidelines for scoring: Teeth were scored for erosive tooth wear using the criteria given in Table 1. Only natural tooth surfaces were examined. If a crown, abutment, pontic or other restorative materials covered a surface of a tooth eligible for examination, a '9' was scored. Partially erupted (less than 75% erupted) teeth were excluded from all surface assessment and a '9' was scored. Teeth sustaining traumatic damage were excluded from all surface assessments and an '8' was scored. The examiner probed for a history of trauma to confirm a score of '8'. 4) Missing teeth identified in the tooth count was coded with a '9'. 5) A periodontal probe (2mm band) was used to estimate the diameter of any exposed dentin facet if necessary in scoring code '2'. 6) Where wear was severe, it could often be contiguous from palatal into incisal, such that it is difficult to distinguish the surfaces. In these instances both surfaces were coded.

Questionnaire: Parents and the participants were asked to complete separate parts of the oral health questionnaire. Data gathered from the parental questionnaire included information on gender, race, parental education level, fluoride history and general oral hygiene habits and status. Children completed a questionnaire on dietary habits relating primarily to the consumption of acidic beverages and foods. Missing responses were clarified with respondents. The oral health targeted information regarding on the participant's putative dietary intakes (sweet, sour, fizzy drinks, citrus fruits, candies etc.) and oral hygiene (brushing habits, fillings and dental attendance). Special attention was given to citric acid products; Lucas, saladitos, Chinese candy (chamoy) and like confections, whose availability and presumed use has grown recently in San

Antonio and the US. One of the major brands of such products has recently been purchased by a large international candy manufacturer.

ETHICAL APPROVAL

Institutional review: This study was approved by the San Antonio Independent School District and by the University of Texas Health Science Centre San Antonio IRB.

Subject Consent (recruitment and compensation): Explanatory letters with consent forms were distributed in selected classroom/ homerooms to parents of all children, and returned via the class/homeroom teacher and school nurse. One of the investigators entered children into the study by verifying and counter signing the form of consent. The consent form and other study data were secured. Identifying data was accessible only to the researchers and staff. Subjects were assigned a code number on the case forms. No monetary compensation was paid for participation; each participant was supplied with an oral hygiene kit in appreciation of participation.

DATA COLLECTION

Case report forms: Case report forms (CRFs) were used for recording all data. The investigator was responsible for maintaining original consent forms, medical histories, questionnaires and all other CRFs and other source documentation. All CRFs were filled out legibly in ink. Children whose parents consented but who were not examined (e.g. due to school absence or personal refusal) were not entered in this study. They were recorded as such on the consent form, and accounted for.

Translation of letter, consent and questionnaire: Spanish translation of the letter to the parents, consent form and parental questionnaire were made, tested among Spanish speakers for idiom in San Antonio, translated back, and amended, and then submitted to the IRB for approval. The student questionnaire was not translated. The few students who did not read English were assisted in completing the form with a bilingual study staff member.

STATISTICAL ANALYSIS

Data Analysis

Tooth wear/erosion index scores were calculated and summarized. ASTDD screening scores were compared with goals for Healthy People 2010 and state norms for the Medicaid and CHIP populations (20). Descriptive statistics was performed on this data set using Statistical Packages for Social Sciences (SPSS) version 11.5. Erosion/tooth wear in relation to total and grouped putative food frequencies was assessed and tested for significance of the association using the Chi-square statistic.

H. RESULTS

A convenience sample of 307 children aged 12-14 years were included from two Junior High Schools in the Southwest Independent School District of San Antonio, Texas.

Prevalence of Erosive Tooth Wear: Of the 307 children included in this study, 15 (5.5%) had erosive tooth wear. The erosion severity was low i.e. did not exceed 0.5 score on the Tooth Wear Index Scale (Table 1). The remaining 292 children did not show any erosion. Our results showed an overall prevalence of erosion to be 5.5% (6.3% and 4.9% in each of the two schools). All affected children showed erosive tooth wear confined to the enamel with no exposed dentin. The

two schools were shown to have a slight variation in the prevalence of erosive tooth wear. MacAuliffe Junior High School showed a prevalence of 8.3% in the seventh grade and 5.6% in the eighth grade. Scobee Junior High School showed prevalence of 2.9% in the seventh grade and 7.7% in the eighth grade (Table 2). The male to female ratio was found to be 44% males and 55% females. The prevalence of erosive tooth wear was seen to be 5.9% in males and 5.3% in females.

Dietary influence on erosion: When an event under investigation is relatively a common occurrence, as shown in our results, the difference in sample proportions and the chi-square test can be used as a statistical tool for analysis. The food groups were divided into two categories: acidic beverages and acidic foods. The sum of the frequencies of intake of each of the three beverage subgroups (juices, sodas plus sports drinks, and other beverages-milk and water) and five food subgroups (fruits, sour candies, Lucas, saladitos and pickles) was calculated and the cutoff for high and low intakes was set at approximately the 50th percentile. A 2x2 table was formulated and the proportions were then calculated using the SPSS software (Tables 3 & 4). The differences of sample proportions were then calculated. The difference in proportions of children with erosion and having high versus low intake of putative foods was greater than these same differences in proportions for children without erosion (Table 5, 6 and 7).

Chi-square test: The chi-square test measures the probability of the presence or absence of an association between characteristics. It does not measure the degree of the association. The results show no significant association ($p<0.05$) between the frequency of intake and prevalence of erosion for all the putative food groups tested. The relationship of juice and soda to erosion was due to chance slightly more than 5% of the time (Table 8 & 9); however the intake of milk and water, presumed to be protective against erosion, was due to chance less than 5% of the time

(Table 10). Citrus fruits and acid candies association with erosion was not significant (Table 11 and 12). Further it was surprising that 'Lucas' and 'saladitos' (Mexican citric acid/salt confectionaries) and pickles were not associated with erosion (Table 13-15). However the relationship of fruits and saladitos to erosion was due to chance slightly more than 5% of the time. Overall, no significant associations were found between erosive tooth wear and frequency of intake of groups of acidic foods and beverages using a non-validated putative food intake questionnaire.

General Awareness: When the children were asked general oral health awareness questions, of the 307 children included in the study, 169 (55%) children reported being satisfied with the appearance of their teeth and 49 (16%) children reported being dissatisfied.

Two hundred and four (67%) children reported being aware of fillings in their mouths while, 101 (33%) reported not being aware. Two hundred and fifteen (70%) children were aware of bad breath, 43 (14%) reported not having bad breath and the remaining 14 (5%) children reported that they did not know. When asked if their teeth ever hurt, 141 (46%) reported no pain, 135 (45%) children said they rarely had pain. The remaining 28 (9%) children did not know if they ever had pain.

Half the children reported brushing two times daily. One hundred and twenty five (41%) children reported brushing more than 60 seconds. One hundred and twenty eight children (42%) brushed less than 60 seconds and the remaining children did not know. Two hundred and forty eight (80%) children reported using manual tooth brushes. When asked about the use of toothpaste, 217 (71%) children reported using an 'all-in one tooth paste', or one that combined caries prevention/whitening/mouth freshening effects.

Dental attendance: Of the 307 children, 75 (24%) children reported visiting a dentist less than once a year. Ninety one (30%) children visited the dentist at least once a year. The remaining 130 (42%) children visited the dentist twice or more in a year. Of the 307 children, 149 (49%) children received a professional cleaning at least once a year. Fifty five (18%) children reported this more than once a year. The remaining 98 (32%) children did not know. When asked about receiving a dental advice, 166 (54%) children reported receiving it and the rest reported not receiving dental advice. Of the ones who received such advice, a majority of them reported getting advice from a dentist or their parents. Very few reported by received such advice from other sources.

Knowledge of putative foods: When the children were asked if they believed certain foods or habits were bad for their teeth, 109 (35%) children reported improper brushing habits, sweets and chocolates, sodas and sugary foods were bad for teeth. The remaining 103 (34%) children thought fruits juices were bad for their teeth. Few reported acidic foods to be harmful.

Screening Questions: The ASTDD oral screening system was used to help relate these children's oral health to the US Goals for Health People 2010 for adolescents and children. Of the 307 children, 44% were caries free, 43% had prior but no present caries (filling but no cavities), 12% had cavities at present, 41% had preventive sealants, and 3% of the children had urgent treatment needs. This shows that the target set for Healthy People 2010 is relatively attainable for this convenience sample of predominantly Hispanic children in the Southwest sector of San Antonio (Table 17).

I. DISCUSSION

This study focused on determining the prevalence of dental erosion within the study population as well as the existence of association between various putative risk factors for dental erosion.

The 5.5 % erosion prevalence for 12-14 years olds observed in the present study is lower than that reported in the prior UK survey for 11 years old (25%). Also, unlike the UK studies the erosive severity is low, with all observed erosive tooth wear confined to the enamel with no exposed dentin. UK studies reported exposed dentin in 53% of children examined in North West England and 52% in Birmingham (19), while Liverpool and London studies reported 30% and 1-2% respectively (4).

Although case control, cross sectional studies and numerous case reports in the UK and other countries report diet to be an important etiological factor for the development and progression of erosion (16-23), the present study showed no significant associations between erosion and specific food groups .The erosive effect of citric, malic, phosphoric and other acids in beverages and food stuffs has been demonstrated in many *in vitro, in situ and in vivo studies* (26-37). A study in Leicestershire and Rutland showed a positive association between erosion and drinking fruit juice and carbonated drinks, and demonstrated that risk of erosion bore a strong relationship to the amounts and frequency of carbonated drink consumption. The prevalence of erosive tooth wear in the UK has been attributed to the easy availability and increasing rate of consumption of acid beverages. In 2000, the consumption of soft drinks and fruit juices in England amounted to over 120 liters per capita, representing on average of 50% of the total individual fluid consumption (24). A similar trend has been reported for the US where the consumption of soft drinks has increased by 300% in 20 years. Between 56% and 85% of children in school consume at least one soft drink daily (25). Despite this similarity in the trend of consumption of acidic beverages consumption between UK and US the results of the present study are contrary in terms of associations between erosion and the putative risk factors (acidic beverages). The low prevalence and low severity of erosion was also unexpected, given the

presumed rising intake and increased promotion of putative foods specific to Mexican Americans. However, it is well known that other factors may determine the occurrence of erosion in individuals. It has also been shown that the method of drinking can influence the manifestation of dental erosion. While keeping drinks in the mouth for a longer period or swishing them around in the mouth enhances the erosive effect (38), drinking with straw (a common practice in US) limits the contact of the drink with the tooth surface thereby limiting the erosive effect. The design of the questionnaire used in the present study may also influence the results. It was not designed by the San Antonio investigators. It was obvious that the questionnaire was complicated and confusing for students. The questionnaire was also non-validated and did not conform to recall dietary questionnaires used in standard dietary evaluation. This made the interpretation of the data problematic for reasons of validity and reliability.

There has been a global decline in tooth decay which is related to water fluoridation and other fluorides. Large studies in the past have revealed that there are statistically significant and clinically relevant differences in tooth decay levels of permanent teeth between fluoridated and non-fluoridated communities. Very few studies have shown a lower risk of dental erosion in fluoridated communities. One such study in recent times was in Irish school children. It showed that fluoride exposure during the first 12 years of life reduced dental caries in this population, and may also protected teeth from wear to some extent (40). An epidemiological study conducted in the west of England looked at tooth wear and dental erosion in 14 years old children and its relationship with water fluoridation and social deprivation. The results showed that children in non-fluoridated districts are 1.5 times more likely to have smooth surface wear compared with children in fluoridated districts. Fluoridation and the use of fluoridated toothpaste

twice a day provide added protection from dental erosion. The risk of tooth wear was greater with increasing affluence (41). Erosion is clearly a 'multi-factorial' condition and further investigation of the relative importance of these factors is required. Despite the present findings, the clear correlations between diet and erosion observed in past studies provide strong evidence for dietary intervention in developing preventive strategies for dental erosion.

J. CONCLUSIONS

This study found a low prevalence and low severity of dental erosion for children between 12 and 14 living in Southwest San Antonio Texas. Sampling and response bias issues preclude these findings being generalized to other populations and regions. Because the local consumption of some putative risk foods appears to be increasing, this study provides a baseline for future assessments of erosive tooth wear in this population.

K. CHANGES, WERE THE PROJECT TO BE REPEATED

1. Issues of sampling and response bias should be dealt with more carefully in order to be able to generalize results to other populations and regions.
2. Major changes in this project would be directed towards the dietary assessment questionnaire. As discussed, it was obvious to the observer that the questionnaire was complicated and confusing for students. The questionnaire was also non-validated and did not conform to recall dietary questionnaires used in standard dietary evaluation. This made the interpretation of the data problematic and this should be addressed in future studies.

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M. APPENDIX

Table 1. Tooth Wear Index

Score	Surface	Criteria
0	All	Sound natural tooth surface
0.5	All	Any wear is restricted to the enamel and does not extend into dentin
1	All	Loss of enamel just exposing dentin
2	B/L	Loss of enamel exposing dentin for more than an estimated one third of the individual surface area
	O/I	Loss of enamel and extensive loss of dentin, but not exposing secondary dentin or pulp. On occlusal/incisal surfaces exposed dentin facets with a buccal-lingual of dimension 2mm or greater at the widest point will be seen
3	B/L	Complete loss of enamel on a surface, pulp exposure or exposure of secondary dentin where the pulp used to be. Frank pulp exposure is most unlikely.
	OI	Pulp exposure or exposure of secondary dentin
8	All	Fractured tooth; clear evidence of traumatic loss of tooth substance rather than wear.
9	All	Can not assess. More than 75% of surface is obscured, no remaining insical edge/tip that can be coded, includes missing teeth, crowns and abutments

B=Buccal; L=Lingual; I=Incisal; O=Occlusal

Table 2: Prevalence of Erosion

Grades	Number of students	Schools	Prevalence of Erosion
7th	193	MacAuliffe	8.3%
		Scobee	2.9%
8th	114	MacAuliffe	5.6%
		Scobee	7.7%

Table 3. 2X2 Contingency Tables: (Acidic drinks)

Count

		JUICES		Total
		1	2	
EROSION	0	153	137	290
	1	5	12	17
Total		158	149	307

Count

		SODAS		Total
		1	2	
EROSION	0	146	144	290
	1	5	12	17
Total		151	156	307

Count

		OTHERS		Total
		1	2	
EROSION	0	159	131	290
	1	5	12	17
Total		164	143	307

0-No erosion; 1- Erosion; 1- Low intake of juices; 2-High intake of juices

Table 4. 2X2 Contingency Tables: (Acidic Foods)

Count

		FRUITS		Total
		1	2	
EROSION	0	144	129	273
	1	4	11	15
Total		148	140	288

Count

		CANDIES		Total
		1	2	
EROSION	0	135	139	274
	1	6	11	17
Total		141	150	291

Count

		LUCAS		Total
		1	2	
EROSION	0	152	110	262
	1	6	9	15
Total		158	119	277

Count

		SALADITOS		Total
		1	2	
EROSION	0	127	126	253
	1	3	11	14
Total		130	137	267

Count

		PICKLES		Total
		1	2	
EROSION	0	116	153	269
	1	4	10	14
Total		120	163	283

0-No erosion; 1- Erosion; 1- Low intake of juices; 2-High intake of juices

Table 5. Difference in proportions of children with and without erosion, having high and low intake* of putative drinks

Juices	Sample proportions	Difference in sample proportions
High intake/ no erosion	0.47	- 0.06
Low intake/no erosion	0.53	
High intake/ erosion	0.71	0.42
Low intake/ erosion	0.29	
Sodas	**Sample proportions**	**Difference in sample proportions**
High intake/ no erosion	0.50	0
Low intake/no erosion	0.50	
High intake/ erosion	0.71	0.42
Low intake/ erosion	0.29	
Others (water, milk)	**Sample proportions**	**Difference in sample proportions**
High intake/ no erosion	0.45	- 0.10
Low intake/no erosion	0.55	
High intake/ erosion	0.71	0.42
Low intake/ erosion	0.29	

***cut off high/low set at 50th percentile of frequency of intake of each food type**

Table 6. Difference in proportions of children with and without erosion having high and low intake* of putative foods

Fruits	Sample proportions	Difference in sample proportions
High intake/ no erosion	0.44	- 0.09
Low intake/no erosion	0.53	
High intake/ erosion	0.73	0.46
Low intake/ erosion	0.27	
Candies	**Sample proportions**	**Difference in sample proportions**
High intake/ no erosion	0.51	0.02
Low intake/no erosion	0.49	
High intake/ erosion	0.65	0.3
Low intake/ erosion	0.35	
Lucas	**Sample proportions**	**Difference in sample proportions**
High intake/ no erosion	0.42	- 0.16
Low intake/no erosion	0.58	
High intake/ erosion	0.60	0.2
Low intake/ erosion	0.40	
Saladitos	**Sample proportions**	**Difference in sample proportions**
High intake/ no erosion	0.50	0
Low intake/no erosion	0.50	
High intake/ erosion	0.79	0.58
Low intake/ erosion	0.21	
Pickles	**Sample proportions**	**Difference in sample proportions**
High intake/ no erosion	0.57	0.14
Low intake/no erosion	0.43	
High intake/ erosion	0.71	0.42
Low intake/ erosion	0.29	

***cut off high/low set at 50th percentile of frequency of intake of each food type**

Table 7. Difference in proportions of children with and without erosion having high and *low intake* of grouped putative foods*

Acidic beverages and acidic foods	Difference in sample proportion between high/low intakes of putative food.	
	With Erosion	Without Erosion
Fruit Juices – 'Juices'	0.42	- 0.06
Carbonated Beverages and Sports Drinks- 'Sodas'	0.42	0
Milk and Water- 'Other'	0.42	0.10
Fruits	0.46	- 0.09
Sour Candies	0.3	0.02
Lucas	0.2	- 0.16
Saladitos	0.58	0
Pickles	0.42	0.14

***cut off high/low set at 50th percentile of frequency of intake of each food type**

Table 8. Chi -Square Test (Juices)

Juices	Observed Numbers	Expected Numbers	Difference (O - E)	Difference Squared	Chi-Sq Term
No erosion High intake	137	140.7	-3.7	13.69	0.09
Low intake	153	149.3	3.7	13.69	0.09
Erosion High intake	12	8.3	3.7	13.69	1.6
Low intake	5	8.7	-3.7	13.69	1.6
Totals					3.38

Degrees of freedom 1; $p < 0.1$

Table 9. Chi –Square Test (Sodas)

Sodas	Observed Numbers	Expected Numbers	Difference (O - E)	Difference Squared	Chi-Sq Term
No erosion High intake	144	147.4	-3.4	11.56	0.08
Low intake	146	142.6	3.4	11.56	0.08
Erosion High intake	12	8.6	3.4	11.56	1.3
Low intake	5	8.4	-3.4	11.56	1.4
Totals					2.86

Degrees of freedom 1; $p < 0.1$

Table 10. Chi -Square Test (Milk and Water)

Others	Observed Numbers	Expected Numbers	Difference (O - E)	Difference Squared	Chi-Sq Term
No erosion High intake	131	135.1	-4.1	16.81	0.12
Low intake	159	154.9	4.1	16.81	0.10
Erosion High intake	12	7.9	4.1	16.81	2.12
Low intake	5	9.1	-4.1	16.81	1.82
Totals					4.16

Degrees of freedom 1; $p < 0.05$

Table 11. Chi –Square Test (Fruits)

Fruits	Observed Numbers	Expected Numbers	Difference (O - E)	Difference Squared	Chi-Sq Term
No erosion High intake	129	132.7	- 3.7	13.69	0.07
Low intake	144	140.3	3.7	13.69	0.08
Erosion High intake	11	7.3	3.7	13.69	1.33
Low intake	4	7.7	- 3.7	13.69	1.42
Totals					2.90

Degrees of freedom 1; $p < 0.1$ (Yates correction applied)

Table 12. Chi -Square Test (Candies)

Candies	Observed Numbers	Expected Numbers	Difference (O - E)	Difference Squared	Chi-Sq Term
No erosion High intake	139	141.2	- 2.2	4.84	0.036
Low intake	135	132.8	2.2	4.84	0.034
Erosion High intake	11	8.7	2.2	4.84	0.55
Low intake	6	8.8	-2.2	4.84	0.59
Totals					1.21

Degrees of freedom 1; $p < 0.3$

Table 13. Chi –Square Test (Lucas)

Lucas	Observed Numbers	Expected Numbers	Difference (O - E)	Difference Squared	Chi-Sq Term
No erosion High intake	110	112.6	-2.6	6.76	0.06
Low intake	152	149.4	2.6	6.76	0.05
Erosion High intake	9	6.4	2.6	6.76	1.06
Low intake	6	8.55	-2.5	6.25	0.73
Totals					1.94

Degrees of freedom 1; $p < 0.2$

Table 14. Chi –Square Test (Saladitos)

Saladitos	Observed Numbers	Expected Numbers	Difference (O - E)	Difference Squared	Chi-Sq Term
No erosion High intake	126	129.8	3.8	14.44	0.08
Low intake	127	123.2	- 3.8	14.44	0.09
Erosion High intake	11	7.2	- 3.8	14.44	1.51
Low intake	3	6.8	3.8	14.44	1.60
Totals					3.28

Degrees of freedom 1; $p < 0.1$(Yates correction applied)

Table 15. Chi –Square Test (Pickles)

Pickles	Observed Numbers	Expected Numbers	Difference (O - E)	Difference Squared	Chi-Sq Term
No erosion High intake	153	154.9	1.9	3.61	0.01
Low intake	116	114.1	- 1.9	3.61	0.02
Erosion High intake	10	8.1	- 1.9	3.61	0.24
Low intake	4	5.9	1.9	3.61	0.33
Totals					1.39

Degrees of freedom 1; $p < 0.1$(Yates correction applied)

Table 16. Significance of difference in High/Low frequency of intake* of groups of putative foods versus erosive tooth wear

Acidic beverages and acidic foods	Chi-Square Test	Significance
Fruit Juices – 'Juices'	3.38	P<0.10
Carbonated Beverages and Sports Drinks- 'Sodas'	2.86	P<0.10
Milk and Water-'Other'	4.16	P<0.05
Fruits	2.90	P<0.10
Sour Candies	1.21	P<0.30
Lucas	1.94	P<0.20
Saladitos	3.28	P<0.10
Pickle	1.39	P<0.10

*Cut off of high/low set at 50th percentile of frequency of intake of each food type

Table 17: ASTDD Screening Questions

Grades	Number of students	Caries Free	Filling no cavities	Cavities present	Sealants present	Urgent treatment
7th and 8th	307	136	133	36	127	8
%		44%	43%	12%	41%	3%
Past and present caries			43%+12%=55%			
US Goals for 2010		49%	51%	9%	50%	