

Toothpaste Use By Children, Oral Hygiene, and Nutritional Education:

An assessment of parental performance

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Introduction

The Dental Health Education and Community Dentistry Program at West Virginia University involves first-year dental hygiene and dental students in the provision of dental education to West Virginians. Students present tailored, targeted oral hygiene programs to meet various needs throughout the state. A significant amount of education is directed to reaching parents and guardians of young children to help in the effort against early childhood caries and caries in newly erupted permanent teeth. Public service announcements discuss oral hygiene, particularly in February during Children's Oral Health Month. Companies that sell toothpaste and toothbrushes ask people in their advertisements to brush twice a day and floss daily. Despite educational efforts, the bulletin *Trends in Oral Health Status: United States 1999-2004* reported the national caries rate in children age 2-5 is 28%, and the prevalence of decay in permanent teeth in children age 6-11 is 21%.¹ The most recent oral evaluation survey of West Virginia children was in 1998. The results showed 47% of children age 8-18 had caries in their permanent teeth.²

Poor oral health in children has many serious sequelae. Children with untreated caries may have difficulty chewing and may not take sufficient nutrients to grow and develop to their potential. Without proper nu-

Abstract

Purpose: The aim of this study was to determine oral health habits and educational needs of children as reported by their parents or guardians attending a health fair in West Virginia.

Methods: Parents and/or guardians completed a questionnaire about the oral hygiene care, food and beverage consumption of their children. They also demonstrated the amount of toothpaste applied to their children's toothbrush. Toothpaste samples were then weighed.

Results: Eighty-seven parents or guardians participated. An average of 0.53 mg of toothpaste was dispensed per brushing, almost double the recommended amount. Most of the parents or guardians (75%) indicated their children had brushed twice the day prior to completing the questionnaire. Only 21% reported that their children's teeth had been flossed. Most children had a limited soda, sweet drinks, and fruit juice intake.

Conclusions: Participants were apparently knowledgeable about prevention, the need to limit sugary beverages, and the importance of brushing twice a day. They were not as knowledgeable about the need for flossing, providing fruits and vegetables to their children, the significance of not skipping a meal, or the appropriate amount of toothpaste use.

Key Words: toothpaste, parents, nutrition, children, oral health

trition, and with the presence of oral pain, children may show difficulty with concentration and learning. Appearance may be affected by the discoloration of carious teeth, and permanent teeth may be poorly positioned as a result of early tooth loss from decay. In addition, low self-esteem can also result from caries and tooth loss. Ultimately, untreated advanced caries can result in massive infections that could lead to death. The tragic death of 12-year-old Deamonte Driver in 2007 brought national attention to the seriousness of untreated dental caries.³

The domino effect of comorbid-

ities may be interrupted with proper oral health habits and behaviors. An effective home oral hygiene program, as well as nutritional guidance, may prevent caries infection in certain situations.⁴ The American Academy of Pediatric Dentistry recommends that an infant have a dental home with a dental professional and a thorough oral evaluation by 1 year of age to help in the provision of effective home care.⁵ Dental hygienists and dentists would like to have the opportunity to provide instruction to parents or caregivers when the child is approximately 6 months old, approximately when the first

tooth erupts. At that time, the parents are excited and receptive to keeping the child caries-free. Ideally, caries risk assessment, nutritional guidance, oral hygiene instructions, and initial evaluation could occur, and any child who is identified as having a high caries risk could receive the needed attention to limit the child's caries burden.

Additionally, it is likely the child is caries-free between 6 months to a year old. If this is the case, dental hygienists and dentists would have the opportunity to interact with the child in a warm, welcoming, non-threatening environment, alleviating some of the fear and negativity often surrounding dental care. The dental hygienist or dentist could provide education to the parents or guardians about brushing and flossing the child's teeth, the types and amount of toothpaste to use, the effects of sugar exposure, and other oral hygiene aids that are available. Many parents are unaware of the sugars and acid in beverages, especially fruit juices. Consequently, their child may drink sodas and sugary drinks as substitutes for milk and water. Additionally, if children are sipping the drinks over a long period of time, the constant exposure can keep the pH of the teeth's biofilm in the demineralization range and place the child at risk for caries. Early educational efforts could address these issues.

Fluoride use should also be discussed. It is important that the dental hygienist and dentist know the amount of fluoride exposure their pediatric patients have. Hydroxyapatite [Ca₁₀(PO₄)₆(OH)₂] is the primary component of the enamel. During amelogenesis, ingested low levels of fluoride (from food, water, or supplements) can replace the hydroxyl group in some of the hydroxyapatite crystals. The resultant enamel has sites of fluorapatite [Ca₁₀(PO₄)₆F₂], or fluoridated hydroxyapatite, which makes the child's enamel more resistant to dietary acids.⁶ Additionally, enamel in erupting teeth is

permeable to the minerals in saliva. Garcia-Godoy reports that enamel will mature with more acid-resistant surface hydroxyapatite and fluoridated hydroxyapatite in a salivary environment with available fluoride.⁷ Topical applications of fluoride (from toothpastes, varnishes, rinses, gels, and other sources) are expected to protect the outer surface of enamel from acidic challenges in fully erupted teeth.⁶

As a child consumes foods high in dietary sucrose or acid, and the plaque pH drops to a critical value (approximately 5.5), the equilibrium of demineralization/remineralization is shifted toward demineralization of teeth.⁶ Some studies support the role of fluoride in remineralization and caries reduction while some show no correlation between fluoride uptake and caries reduction.⁶ Garcia-Godoy indicates that when fluoride is present in concentrations between 0.03 and 0.08 parts per million in a tooth's biofilm, the fluoride increases the reformation of hydroxyapatite and fluoridated hydroxyapatite.⁷

Too much fluoride is a concern as well. Skeletal fluorosis, dental fluorosis, endocrine changes, neurological effects, and even death may occur with chronic overdose or acute poisoning. The acute toxic level was reported by Beltran-Aguilar et al as 1 mg F/kg body weight.⁸ Whitford reported a probable toxic dose of 5 mg F/kg body weight, suggesting a 1-year-old child of average weight has a probable toxic fluoride level of 50 mg, which could be met by swallowing 3.2 ounces of a typical fluoride toothpaste or 215 ml of a typical over-the-counter fluoride rinse.⁹

Moderate-to-severe dental fluorosis is characterized by mottled, porous, pitted areas in enamel that may flake off. The mottled areas may begin as opaque spots that may stain to shades of yellow and brown.¹⁰ It is important to know a child's fluoride exposure before considering supplementing fluoride. The Environmental Protection Agency's Integrated Risk

Information System database suggests that moderate-to-severe fluorosis may occur with exposure above 0.06 mg/kg/day (0.96 mg for a child weighing 35 pounds), although the 1997 Institute of Medicine places the level at 0.10 mg/kg/day (1.6 mg for a child weighing 35 pounds).¹⁰ De Almeida reported that fluoride intake of 0.05-0.07 mg/kg body weight/day is optimal, but fluorosis could result from levels of 0.04 mg/kg body weight/day in some children.¹¹ Most children in de Almeida's study were exposed to a daily fluoride intake above the threshold for fluorosis, with toothpaste being responsible for 81% of the daily fluoride intake.¹¹ Although fluorosis is a health and aesthetic concern for dental hygienists and dentists, parents in a study conducted by O'Mullane, who had children with a Thylstrup and Fejerskov Index Grade 3 fluorosis, only expressed concern about the appearance of their children's teeth when the investigators drew their attention to the mottling.¹²

The proper amount of toothpaste use is consequential to the overall fluoride exposure of a child, and parents or guardians should have an understanding of the overall fluoride exposures their children have. Dental evaluations conducted when the child's first tooth erupts provide the opportunity to discuss all aspects of preventive care, including the appropriate amount of toothpaste to use, which has been described as a "peasized" amount or "smear" of toothpaste weighing 0.25g.¹³

Limiting the amount of toothpaste is important when a child is too young to expectorate, and instead swallows the toothpaste, especially if the toothpaste is fluoridated. Children 15-24 months old may be at risk of fluorosis of the maxillary central incisors if fluoride exposure is above the optimum, which in one study was as low as 0.04 mg/kg/day.¹¹ Flavorings added to toothpastes may encourage swallowing of the toothpaste.¹² Van Loveren reports

that studies show only 5% of children under age 2.5 years and 32% of children ages 2.5-4 years old rinsed after brushing (27% rinsed and swallowed all or almost all of the rinse). Parents need to know the possibility of additional fluoride exposure if young children are using and swallowing fluoride toothpaste.¹⁴

Effective oral hygiene education programs should not only address toothpaste use, brushing, flossing, and nutrition, but also early preventive care, which many children do not receive. Children from households of lower socioeconomic status are reported to have more oral health problems, some of which are related to accessing care, than children from households of higher socioeconomic status.⁶ Approximately 66% of children nationally receive 1 yearly preventive dental visit - the very young often do not receive any dental care.¹¹ There are many factors for children not receiving dental care: lack of interest by the parent or guardian, distance to a dental office, lack of transportation, and inability to pay for care. Without the opportunity to receive instructions, some parents may not learn of ways to improve their child's oral health and well-being. Outreach educational programs are initiated to help bridge the gap, provide convenient locations for educational opportunities, and encourage follow-up dental visits. These programs are becoming increasingly important to meet people's needs with quality information about preventive care.

Methodology

A convenience sample of West Virginia parents and/or guardians of children under the age of 15 were recruited for the study. The participants, who were attending a health fair, enlisted to help researchers determine amount and type of toothpaste, the oral hygiene protocols in place, and beverage consumption of their children. The need for ad-

ditional oral hygiene and nutritional education was also determined. Participants completed a survey which included questions about frequency of brushing, flossing, and type of toothpaste. A short description of the beverages and food consumed the day before the study was also provided by parents or guardians. They were also asked to demonstrate the amount of toothpaste typically applied to their child's toothbrush. Gum[®] youth toothbrushes were weighed upon a Denver Instrument MXX-612 balance. The parent or guardian applied toothpaste (Crest, Regular Paste[®]) to the brush, and a total weight was obtained.

Results

There were 87 participants: parents and/or guardians of 43 girls and 44 boys. The average age of the children was 5.4 years.

The mean amount of toothpaste used by participants in this study measured 0.53±0.07g with a range of 0.11g to 1.41g. This is approximately twice the recommended amount of 0.25g. The parents or guardians of 0- to 3-year-old children used a mean of 0.44±0.14g. According to parents or guardians, 75% (65) of children were brushed 2 or more times a day. Seventy-five percent (65) used fluoride toothpaste. Of the children under 3 years, 8% (2) of their parents did not know if the toothpaste had fluoride; 41% (9) used nonfluoridated and 51% (11) used fluoride toothpaste. Overall, 21% (18) of parents or guardians reported their children's teeth were flossed daily.

Median and range of beverage consumption for the previous day are presented (Table 1). Foods and beverages consumed by children at the most recent meal or snack are summarized in Table 2.

Discussion

The average parent or guardian brushed their children's teeth twice

Table 1. Children's Median and Range of Beverage Consumption for the Previous Day

Variable	Median (in cups)	Range (in cups)
Soda	0	0-4
Sweet Drinks	0	0-4
Fruit Juice	0	0-10
Milk	2	0-10
Coffee	0	0-1
Tea	0	0-3

daily, but did not floss daily. Flossing should remain a major topic in oral hygiene education presentations.

Seventy-five percent of children used fluoride toothpaste, while 51% of children less than 3 years old used fluoride toothpaste. Parents were using more than the recommended amount of toothpaste, especially with children in the 0- to 3-year-old range.

Although toothpaste is not intended to be swallowed, many children do swallow toothpaste. Martinez-Mier reported that children 15-36 months ingested between 10% and 99.8% of the toothpaste on their toothbrushes.¹⁵ It is important to educate parents about the proper amount of toothpaste to use. Dentists' and dental hygienists' educational programs should include discussions of a "pea sized" amount or "smear" of toothpaste and demonstrate that amount.

It is also important that dental hygienists and dentists know the amount of fluoride to which the child is exposed, so they can discuss fluoride use and over-use with parents or guardians. Source of fluoride may include water (which may be from multiple locations and may include bottled water), prescription multiple vitamins from the child's pediatrician, and toothpaste. With combined ingestion from multiple sources, total levels of fluoride could lead to fluorosis. Pendrys reports that one third of fluorosis cases in nonfluoridated

areas and two thirds of fluorosis cases in fluoridated areas are attributable to early fluoridated toothpaste use, and two thirds of mild-to-moderate fluorosis cases in nonfluoridated areas are attributable to fluoride supplements with the pre-1994 protocol.¹⁶ Anticipatory guidance about keeping fluoride toothpaste, fluoride rinses, and fluoride tablets out of the reach of children is recommended.

The study also indicated a need for nutritional education. According to parents or guardians, most children had few exposures to sugary beverages (soda, sweet drinks, and fruit juices). However, there were 80 exposures to processed carbohydrates. The survey, conducted between 10:00 a.m. and 2:00 p.m. on a Saturday, showed 25.4% missed breakfast. Meat or eggs were eaten by 35 and dairy products by 46 children at their most recent meal. Parents provided a diet high in processed carbohydrates but low in fruits and vegetables (6 children had a piece of fruit and 1 child had a vegetable). Educational programs that emphasize the importance of not skipping a meal and providing more fruits and vegetables to children continue to be needed.

This study was conducted at a health fair for children with a convenience sample of 87 parents and/or guardians, which presents a limitation. Because of the limited sample, care should be taken generalizing the results to other populations. It is possible that since the parents were attending a health fair the sample was more health conscious. It is also possible parents were aware of the “expected correct” responses and adjusted their responses as a result.

Conclusion

Despite the great strides made in eliminating caries, it continues to be the most common chronic pediatric disease in the United States.¹⁷ Dental hygienists and dentists have significant roles in the provision of

Table 2. Food and Beverages consumed by children at their most recent meal or snack

Breakfast (61 children)	Number of children eating the food (quantities not available)
Cereal (with milk)	25
Meat (Bacon, Sausage, Pepperoni)	13
Toast/Bagel/Biscuit and gravy	12
Pancake/Crepe/Waffle/French Toast	11
Eggs	10
Pastry/Cereal Bar/Graham Crackers/PopTart®	8
Fruit (Banana/Grapes/Strawberries)	6
Yogurt/cheese	3
Chinese/Ramen noodles	2
Pizza	1
Milk (in addition to cereal)	13
Juice	4
Lunch (17 children)	
Bread (Sandwich bread/hotdog bun)	5
Meat (Sandwich/hot dog/chicken)	10
French fries	5
Pizza	3
Chinese/Rice	2
Spaghetti	1
Yogurt	1
Green beans	1
Milk	4
Dinner (1 child)	
French Fries/Potato Chips	1
Meat (Chicken, meat in taco)	1
Taco Shell	1
Snack (4 children)	
Candy	1
Pretzel	1
Cereal	1
Chips	1

education to parents and/or guardians concerning pediatric oral and nutritional health. This study’s findings identified clinical aspects of oral health education in which the dental team may help mitigate the caries epidemic and limit the possibility of fluorosis. Such education includes: showing parents the recommended amount of toothpaste to use for chil-

dren, having parents demonstrate the application on a toothbrush, showing parents how to floss their child’s teeth and observe and correct them as they perform the procedures on their child or in simulation, and counseling parents about balanced, regular meals and the importance of not skipping meals.

We also identified questions for

further study regarding oral health education for parents. How can the dental team be certain that the oral hygiene message is conveyed? What constitutes the most effective presentations? How can we verify learning has occurred? How do we perpetuate the motivation that is initiated and encourage parents to follow through in the provision of proper oral hygiene and nutrition to their children? Are incentives, rewards, or punishments appropriate? At what level should state, local, or federal governments intervene? Dental hygienists are faced with the same teaching obstacles as any other teacher. The

information must be heard, understood, and internalized. Parents must develop skills to perform the home care their child requires. Even with a clear understanding of oral hygiene and nutritional needs, parents may not follow through with the desired behavior. Obstacles in daily living may erode parents' motivation and sense of necessity to address the dental needs of their children. These issues are complex and require further study.

Having basic dental knowledge may make it possible for the national caries trend to be arrested and reversed. The findings of this study

can help the dental hygienist know which additional information to share with parents to help improve nutrition, oral health, and safety, along with the usual topics of how and when to brush and floss.

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