Original Article

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Dentistry Section

Impact of Verbal and Visual Training on Amount of Toothpaste Dispensed by Parents and Children: A Quasi Experimental Study

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ABSTRACT

Introduction: Fluoride prevents dental caries however excessive utilisation of fluoridated toothpastes can lead to dental fluorosis. Hence, parents and children should be instructed regarding toothpaste dispensing quantities.

Aim: To determine the effectiveness of visual and verbal aids in instructing parent-child dyad regarding toothpaste dispensing patterns.

Materials and Methods: A pretest-post-test quasi experimental study was conducted comprising of 70 parents and children aged 3-6 years in the department of Paediatric and Preventive Dentistry, DY Patil University of Dentistry, Navi Mumbai, India from September to December 2023. Data on toothpaste and toothbrush type were collected. Toothpaste dispensing was assessed at baseline, after parental counselling with visual and verbal aids (T0) and after atleast three months (T1). One-way ANOVA and Tukey HSD post-hoc test was used to compare difference in weight of toothpaste dispensed at all time intervals. Unpaired t-test was used to compare amount of toothpaste dispensed by parent and child at all time intervals.

Results: A total of 44 (62.9%) of parents utilised adult toothpaste and 7 (10%) used adult toothbrushes while brushing their child's teeth. Parents and children dispensed an average 0.62±0.29 mg and 0.74±0.34 mg, respectively. However, a noticeable reduction in usage from baseline to T0 and T1 was observed in both parent and child groups ($p<0.001$*).

Conclusion: Parents and children dispensed beyond recommended amount. Children, dispensed more toothpaste than their parents at baseline, immediately after counselling and after three months, emphasising need to monitor toothpaste use in preschoolers to avert dental caries and fluorosis. The noticeable reduction in parental usage shows positive impact of visual and verbal guidance in their dispensing habits.

Keywords: Counselling, Dental fluorosis, Education, Fluoride

INTRODUCTION

Fluoride is a significant contributor to oral health, and its discovery and adoption as a preventive measure for dental caries has been a significant development in the last century [1]. However, excessive fluoride consumption can result in dental and skeletal fluorosis. The main source of fluoride exposure leading to dental fluorosis is drinking water and dental products such as toothpaste, mouthwashes and fluoride supplements [1]. Among these, fluoridated toothpaste is an affordable and culturally acceptable way to introduce fluoride to the public [2]. Studies have confirmed its efficacy in reducing dental caries, particularly in children with higher baseline levels of dental caries [2,3]. However, use of fluoridated toothpaste also increases the prevalence of dental fluorosis, which is a significant public health concern, especially in countries that lie in geographical fluoride belt, like India [4].

Children often receive a significant amount of fluoride through toothpaste. Their inability to properly spit it out due to under-developed reflexes along with the appealing flavours of toothpaste can result in unintentional ingestion. This can lead to absorption of fluoride into their body potentially causing dental fluorosis [4]. Permanent dentition is vulnerable to fluorosis during the first seven years of life. Excess fluoride ingestion beyond the recommended level may worsen this condition [5].

American Academy of Paediatric Dentistry (AAPD) advises using a rice grain size of toothpaste (approximately 0.1 mg of fluoride) for children under three and a pea-size amount - 0.25 g (approximately 0.25 mg of fluoride) for children aged three to six to minimise the risk of fluorosis [3]. Despite these guidelines, many parents, regardless of nationality, dispense more than the recommended amount [6]. Relying on terms like 'smear' or 'pea' for guidance can be ambiguous which shows the knowledge gap amongst parents regarding the right amount and type of toothpaste for their children [7]. It also emphasises the need to educate parents about recommended toothpaste amounts, concentration of fluoride in it as well as importance of supervising their children's brushing.

Zhou N et al., (2019) conducted a study utilising the Visual-Verbal Integration Model (VVIM) to instruct parents and children with disabilities on proper amount of toothpaste use. VVIM, rooted in Mayer's multimedia learning theory, suggests that integrating visual aids with verbal explanations enhances learning [8].

The present study is aimed to evaluate toothpaste utilisation habits of parents and children aged 3 to 6 years using visual and verbal aids in educating parents on appropriate toothpaste dispensing amounts. The study also highlights the need for educating parents on appropriate toothpaste usage for their children to minimise risk of dental fluorosis while maintaining benefits of fluoride in preventing dental caries. The present study is the first known study in India which used this technique.

MATERIALS AND METHODS

The present pretest-post-test quasi experimental study was conducted between September to December 2023 in the Department of Pediatric and Preventive Dentistry, DY Patil University School of Dentistry, Navi Mumbai, Mumbai, India. It was reviewed and approved by the University Ethical Committee (Reference Number: FRC/2022/PEDO/09).

Sample size calculation: Sample size was determined on the basis of power analysis where a sample size of 48 child and parent pair would be required to achieve 80 percent power and α=0.05. It was determined using formula n = $(Z\alpha/2+Z\beta)^{2*}$ (p1(1-p1)+p2(1-p2))/ $(p1-p2)^2$ from a previous study [9]. Considering 10% attrition rate the sample size was rounded-off to 70 pairs, thus a total of 70 pairs of parent and child pair were included in this study.

Inclusion and exclusion criteria: The study included healthy children aged three to six years and their parents, willing to participate. Those with mental or physical disabilities, developmental delays, or other medical conditions were excluded for result accuracy and safety. Chosen participants provided consent.

Study Procedure

A single investigator recorded data on type of toothpaste and toothbrush used at home (adult/child), as well as who usually brushes the child's teeth. Parents were shown two toothbrush options- one for adults and one for kids- and asked to identify the type they use at home. To ensure precision, toothbrushes were preweighed using an electronic scale accurate to 0.01 g. Separately, parents and children were then asked to dispense their typical amount of toothpaste from a disguised 1000 ppm fluoridated adult tube, ensuring neither could see other's quantity.

Both child and parent separately dispensed toothpaste onto a toothbrush. Toothpaste's weight was calculated by subtracting the preweighed toothbrush's weight from combined weight of the brush and paste. This was done thrice using new preweighed toothbrushes each time, ensuring accuracy. An average weight was then determined for each participant, reflecting typical toothpaste usage. Post-measurement, parents were counselled on their child's oral health, emphasising parental oversight in toothpaste dispensing, using child-appropriate toothbrush sizes, and adhering to age-specific toothpaste quantities. This was done to ensure whether the children received the right fluoride amount without overuse or underuse.

Parents and children received verbal and visual guidance on toothpaste usage. They were verbally educated of AAPD's advice to use a pea-sized amount (0.25 g) for children aged three to six years [3]. A visual aid depicted toothpaste amounts for different ages, emphasising pea-sized 0.25 g recommendation. The investigator further dispensed and demonstrated this recommended amount.

Immediately after counselling session was complete, both parent and child were asked to sit separately and dispensed toothpaste three times using fresh brushes, with each amount noted and then averaged. After a minimum of three months, parent-child pairs were recalled and asked to dispense toothpaste as they did in prior sessions. The dispensed toothpaste was weighed and noted. Of the initial 84 pairs, 70 were assessed by end of baseline evaluation. Fourteen pairs were lost to follow-up. Data was captured at baseline, immediately post-counselling (T0), and after three months (T1). All data underwent statistical analysis.

STATISTICAL ANALYSIS

Statistical procedures in this study involved two steps: data compilation and presentation, and statistical analysis. Data was compiled and presented in individual tables and graphs on a Microsoft Excel worksheet 2020 (Microsoft, USA). Statistical analysis was conducted using IBM Statistical Package for Social Sciences (SPSS) Statistic for Windows (version 21.0. Armonk, NY: IBM Corp), and specific tests were applied to determine the significance of results. Mean, standard deviation, and proportions were calculated. Different tests were used for different types of data, including Chi-square test of proportion, unpaired t-test, One-way ANOVA, and Tukey HSD post-hoc test.

RESULTS

A total of 36 (51.5%) boys and 34 (48.4%) girls with mean age of 5.45±1.15 years and 9 (13%) fathers and 61 (87%) mothers with mean age of 38.2±0.1 years were included in this study. [Table/Fig-1] shows the distribution of study participants according to the person performing tooth brushing. Only 10 (14.3%) child-parent pairs performed tooth brushing together. A total of 44 (62.9%) children used adult's fluoridated toothpaste and only 3 (4.3%) children used non-fluoridated toothpaste [Table/Fig-2]. A total of 63 (90%) participants used children's toothbrush while 7 (10%) participants used adult's toothbrush [Table/Fig-3].

Person performing	Frequency	Percent	Chi-square	p-value
Child	30	42.9	11.42	0.003*
Parent	30	42.9		
Both	10	14.3		
Total	70	100.0		

[Table/Fig-1]: Distribution of study participants according to person performing tooth brushing.
*statistically significant at p<0.05

Type of toothpaste	Frequency	Percent	Chi-square	p-value
Children's fluoridated	23	32.9	36.02	0.001*
Adult's fluoridated	44	62.9		
Non-fluoridated	3	4.3		
Total	70	100.0		

[Table/Fig-2]: Distribution of study participants according to type of toothpaste used.
*statistically significant at p<0.05

Type of toothbrush	Frequency	Percent	Chi-square	p-value
Children	63	90.0	44.50	0.001*
Adult	7	10.0		
Total	70	100.0		

[Table/Fig-3]: Distribution of study participants according to type of toothbrush used.
*statistically significant at p<0.05

[Table/Fig-4] shows the difference in mean weight of toothpaste dispensed at all time intervals. There was significant difference in weight of toothpastes dispensed by the parent and child at different time intervals.

Person performing	Baseline	T0	T1	p-value
	Mean±SD (gram)			
Parent	0.62±0.29	0.28±0.06	0.35±0.07	<0.001*
Child	0.74±0.34	0.35±0.07	0.36±0.10	<0.001*

[Table/Fig-4]: Difference in mean weight of toothpaste dispensed by parent and child at all time intervals.
*statistically significant at p<0.05

[Table/Fig-5] shows the difference in mean weight of toothpaste dispensed at all time intervals using one-way ANOVA and Tukey HSD post-hoc tests. Children and parents both dispensed significantly higher amount of toothpaste at baseline compared to T0 and T1 (p<0.001). [Table/Fig-6] shows the comparison of mean weight of toothpaste dispensed at all time intervals using unpaired t-test. During baseline and T0, there was no significant difference between the amount of toothpaste dispensed by parent and children (p>0.05). During T1, children dispensed significantly more toothpaste than their parent (p=0.014).

DISCUSSION

The present study showed that children dispensed more toothpaste than their parents at all time intervals. Meanwhile there was a positive impact of visual and verbal guidance on the toothpaste dispensing habits of parents. It is crucial to understand how much toothpaste parents or caregivers dispense to young children in order to determine their exposure to fluoride and its effects. The present study found that 62.9% of parents used adult toothpaste for their children's teeth, which was consistent with study by Bennadi D et al., (2014) [9]. However, 32.9% of parents in the study used toothpaste

Toothpaste dispensed by	Time interval (Mean)		Mean difference	Std. error	p-value
Parent	Baseline (0.62)	T0	0.34	0.029	<0.001*
		T1	0.27	0.029	<0.001*
	T0 (0.28)	Baseline	-0.34	0.029	<0.001*
		T1	-0.07	0.029	0.834
	T1 (0.35)	Baseline	-0.32	0.029	<0.001*
		T0	0.01	0.029	0.834
Child	Baseline (0.74)	T0	0.39	0.035	<0.001*
		T1	0.38	0.035	<0.001*
	T0 (0.35)	Baseline	- 0.39	0.035	<0.001*
		T1	-0.01	0.035	0.92
	T1 (0.36)	Baseline	-0.38	0.035	<0.001*
		T0	0.01	0.035	0.92

[Table/Fig-5]: Difference in mean weight of toothpaste dispensed by parent and child at all-time intervals using One-way ANOVA and Tukey HSD post-hoc.
*statistically significant at p<0.05

Time interval	Groups	N	Mean	Std. Deviation (SD)	Std. Error Mean (SEM)	F	p-value
Baseline	Parent	70	0.62	0.29	0.03	3.215	0.075
	Child	70	0.74	0.34	0.04		
T0	Parent	70	0.28	0.06	0.00	1.984	0.161
	Child	70	0.35	0.07	0.00		
T1	Parent	70	0.35	0.07	0.00	6.243	0.014*
	Child	70	0.36	0.10	0.01		

[Table/Fig-6]: Comparison of mean weight of toothpaste dispensed by parent and child at baseline, T0 and T1 time intervals using unpaired t-test.
*statistically significant at p<0.05

specifically designed for children. This was in contrast with study by Tay HL et al., (2009) where more than a third of children used adult toothpaste and 60.1% children's flavoured toothpaste [10]. Type of toothpaste may affect the amount dispensed due to its colour, packaging, smell and taste. Stovell AG et al., (2013) reported that children preferred toothpaste designed specifically for them, which may encourage them to use more toothpaste and potentially ingest more fluoride [11]. Choudhari S et al., (2020) found that children used more flavoured toothpaste and brushed longer with it [12].

In the current study, 90% of subjects used children's toothbrush and only 10% used adult toothbrush. This consistent to a study done by Tay HL et al., (2009) where 91% used children's toothbrush [10]. Type of toothbrush may also influence the amount dispensed because it has been observed that larger the size of toothbrush more toothpaste is dispensed. Bhuridej P et al., (2007) observed that toothbrush size significantly affected the amount of toothpaste placed for pea-sized and larger amounts. Amounts placed on larger sized toothbrushes were greater than smaller sized toothbrush [13].

When parental supervision during brushing was assessed, 42.9% of parents supervised their children's tooth brushing, 42.9% children brushed on their own and 14% brushed together with their parents and this difference was statistically significant. (p=0.003*) Oral health guidance in United Kingdom recommends parents to supervise brushing until child is at least seven years of age [14]. A national survey conducted by White DA et al., in United Kingdom suggested that a large proportion (50% of five-year-old) brush their teeth without any adult involvement [15]. Mattila ML et al., (2000) found that 62% of five-year-old who were brushing their teeth received assistance from their mother and/or father [16]. Additionally, a study by Naccache H et al., (1992) found that children between the ages of two and seven years who used adult dentifrice, 77% applied the dentifrice to their toothbrush by themselves, and average amount of dentifrice used per brushing was approximately, 0.5 g [17].

In this study, at baseline, parents dispensed a mean amount of 0.62 g of toothpaste. However, after receiving verbal and visual instructions at T0, mean amount dispensed reduced significantly to 0.28 g. This reduction was similar to the findings of Zhou N et al., (2019) also used verbal and visual instructions. In contrast, studies that only provided verbal instructions to dispense a pea-size amount saw most parents dispensing more than recommended 0.25 g [8]. At T1, mean weight of toothpaste dispensed was 0.29 g. Difference between mean amount of toothpaste dispensed at baseline, T0 and T1 was statistically significant (p=0.0001*).

At baseline children dispensed a mean amount of 0.75 g of toothpaste, which is considerably more than recommended pea size amount of toothpaste. This is consistent with studies done where kids dispensed more than recommended level [17]. T0 and T1 mean amount dispensed went down to 0.35 g and 0.36 g, respectively. Similar to parents, difference between baseline and T0 and T1, created a significant difference amongst them. (p<0.05*)

When parents and children were compared with each other, at all steps it can be observed that children have been dispensing more than their parents. Especially at T1, values between parents and children varied considerably which led to a significant difference between them (p<0.05*). Therefore this reinforces the guidelines from AAPD that parents should supervise their child's tooth brushing until the child turns six or seven-year-old [3].

Parents are key motivators for their children's good oral health practices. As children's habits are largely influenced by their parents' knowledge, attitudes, and actions, understanding the existing oral health standards, practices, and attitudes of a particular population is crucial for implementing preventive measures. Parents play a significant role in shaping their child's health-related behaviours and can encourage or discourage specific habits. Lack of oral health awareness among parents can ultimately affect their children's oral health.

Limitation(s)

This study used both verbal and visual counselling methods but did not assess the effectiveness of each separately, hindering determination of individual impacts. Additionally, disguised toothpaste used could differ in colour and fragrance from household brands, potentially influencing the dispensed amount.

CONCLUSION(S)

Only half of the parents supervised their children's brushing. Most parents used adult toothpaste for their children and provided children's toothbrushes. Initially, both parents and children dispensed excessive toothpaste. Yet, verbal and visual counselling notably improved parents' dispensing habits immediately and at a 3-month recall. Children consistently used more toothpaste than their parents, with a significant difference at T1. To reduce dental caries and fluorosis risks, it is essential to consistently monitor and guide preschoolers' toothpaste usage.

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