

## The Effects of Different Application Techniques and Orifices on the Amount of Dentifrice Dispensed

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### Abstract

**Purpose:** The purpose of this study was to evaluate three different methods (ST: Standard technique; PS: Pea-size; TT: Transverse technique) for dentifrice use in children between 5-7 years of age, as well as to compare the amount of dentifrice dispensed by using tubes with different orifices (crescent or round shaped).

**Methods and Materials:** One hundred children who dispensed the dentifrice themselves were asked to apply the quantity of dentifrice they usually used (ST or TT) (Phase-I). In Phase-II they were instructed to apply a PS amount, and in Phase III the TT was demonstrated. Statistical analysis was obtained by using Anova and t-test.

**Results:** Most of the children (82 patients) preferred to use the ST rather than the TT (18 patients). A decrease in the dentifrice amount was obtained with both of the shaped orifices after the instruction of PS or demonstration of the TT ( $p < 0.05$ ). It was observed the amount of dentifrice dispended decreased when a crescent-shaped orifice was used.

**Conclusion:** Children usually preferred to use the ST rather than the TT before the instruction or demonstration by the operator. The amount of dentifrice dispensed generally decreased when a dentifrice tube with a crescent-shaped orifice was used.

**Keywords:** Dentifrice, application techniques, orifice

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## Introduction

Fluoride-containing dentifrices are well accepted for their effectiveness in caries prevention.<sup>1</sup> There is compelling evidence that early, substantial use of a fluoride dentifrice is an important risk factor for dental fluorosis.<sup>2</sup> Recent concerns over the positive association between fluorosis and dentifrice ingestion by young children have resulted in recommendations to use a minimal amount of dentifrice, thus, reducing the amount of dentifrice that may potentially be ingested.<sup>1</sup>

Usually, children's dentifrices contain 1000-1100 ppm F. Use of higher concentration fluoride dentifrices by preschool children should be avoided<sup>3-7</sup>, further development and testing of lower concentration fluoride dentifrices and use of small quantities of dentifrice with parental supervision are encouraged.<sup>7,8</sup> Dentifrices containing 250-500 ppm F are available in developed countries.<sup>9</sup>

Reducing the amount of dentifrice may also be an efficient way to maintain efficacy while decreasing the risk of fluorosis.<sup>1</sup> In these ways, the use of a fluoride dentifrice will continue to be an important caries prevention tool, while minimizing its role in the etiology of dental fluorosis.<sup>7</sup>

Pendrys<sup>10</sup> observed that using more than a "pea size" (PS) amount of dentifrice throughout the first eight years of life contributed to more than 70% of fluorosis in children who grew up in optimally fluoridated communities. With a desire to educate the population in regard to the appropriate use of fluoride, it is recommended children under 7 years of age use smaller quantities of dentifrice with fluoride.<sup>11</sup> Recommendations such as using 0.3 g, 0.5 g, a small quantity, or a "PS" amount have appeared in scientific studies. However, due to cultural factors, nutrition, and translation, there has been difficulty in transmitting these recommendations. A "PS" recommendation also creates confusion due to the great variety of peas and beans found in food markets.<sup>9</sup>

Dentifrice placed in a transverse direction to the bristles of the toothbrush and not in a longitudinal direction is commonly recommended. Villena<sup>9</sup> evaluated a method of placing dentifrice in a transverse relation to the bristles, the transverse technique (TT), and compared it to the standard technique (ST) used and to the "PS" recommen-

dation and concluded the TT could be recommended for young children to decrease the amount of fluoride dentifrice dispensed, minimizing inadvertent dentifrice ingestion and the risk of developing dental fluorosis. In the same study, it was also reported the PS recommendation can create confusion with individual variability whereas the TT was easy to standardize.

Recently, dentifrice tubes with different orifices were produced in order to reduce the amount of dentifrice dispensed. However, there are only two studies evaluating the effect of the orifice shape on the amount of dentifrice.<sup>9,12</sup>

The purpose of this study was to evaluate three different methods (ST, PS, TT) for dentifrice use in children between 5-7 years of age, as well as to compare the amount of dentifrice containing 500 ppm F dispensed using two dentifrice tubes with different orifices.

## Methods and Materials

One hundred children (5-7 years old) who dispensed the dentifrice themselves were selected. Children with appropriate informed consent from their parents were recruited from the Department of Pediatric Dentistry, Faculty of Dentistry, Gazi University. Initially, children were given a toothbrush and asked to apply the quantity of dentifrice which they usually used (ST or TT) (Phase-I). Figure 1 shows the application of the ST preferred by children.

Later, they were instructed to apply a small "PS" amount (Phase-II). Finally children were shown the TT (Phase-III) as pictured in Figure 2. Each child used 3 toothbrushes that were weighed before and after each measurement.

The same brand of toothbrush (Oral-B manual toothbrush) and two dentifrice tubes (Oral-B and I'pana) containing 500 pm F with different orifices (Oral-B, crescent-shaped orifice and I'pana, round orifice ) were used (Figure 3). All children received orientation about oral hygiene when they completed the study.

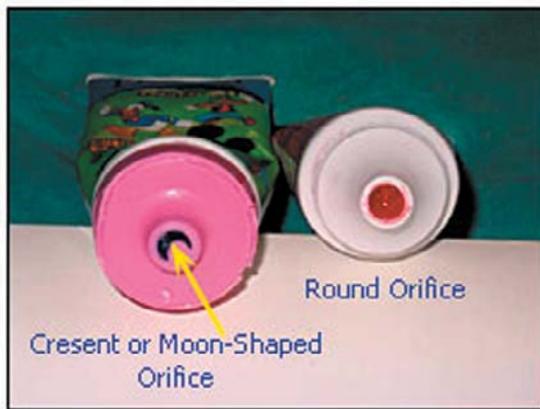
The statistical significance of the differences among the three methods and of the differences between the two dentifrice tubes were evaluated using the Anova test and t-test, respectively.



**Figure 1.** Application of the standard technique (ST) preferred by children.



**Figure 2.** Application of the transverse technique (TT).



**Figure 3.** Dentifrice tubes with different orifices.

## Results

Of the one hundred children who participated in this study, 82 children used the ST and 18 children used the TT in the first phase. The results of the statistical analysis are shown in Tables 1 and 2.

When the three techniques were evaluated in 82 children who used the ST in the first phase, it was observed there was a significant difference between the ST (Phase I) and the other two techniques (PS, TT) in both of the round and crescent-shaped orifices ( $p < 0.05$ ). No significant difference was found between PS (Phase II) and the TT (Phase III) in the same group ( $p > 0.05$ ).

When the three techniques were evaluated in 18 children who used the TT in the first phase, it was observed there was a significant difference between the TT (Phase I) and the other two techniques (PS, TT) in both of the round and crescent-shaped orifices ( $p < 0.05$ ). No significant difference was found between PS (Phase II) and the TT (Phase III) in the same group ( $p > 0.05$ ).

The amount of dentifrice dispensed with the round and the crescent-shaped orifices were compared with the “t-test.” When the amount of dentifrice dispensed by 82 children using the ST in the first phase was evaluated, there was a statistically significant difference among the phases (ST, PS, TT) ( $p < 0.05$ ). But, when the amount of dentifrice dispensed by 18 children using the TT in the first phase was evaluated, there was a statistically significant difference between Phase I and Phase II, and also between Phase I and Phase III ( $p < 0.05$ ), though there was no statistically significant difference between Phase II and III ( $p > 0.05$ ).

## Discussion

In recent years, the prevalence of dental fluorosis has increased in both fluoridated and non-fluoridated communities.<sup>9,13-15</sup> Although dentifrice was not identified as a risk factor for dental fluorosis in many of the earlier studies<sup>16,17</sup>, nearly all studies reported in the last seven or eight years have demonstrated associations between dental fluorosis and the use of fluoride dentifrices in early childhood.<sup>13,18-20</sup>

**Table 1. Amount of dentifrice (grams) dispensed by 82 children using the Standard Technique (ST), a Pea-Size Amount (PS), and the Transverse Technique (TT) with different shapes of orifices.**

Orifice shape	N	Technique	Mean	Standard Deviation
Round	82	ST*	0.3785	0.23001
		PS	0.2384	0.10742
		TT	0.2391	0.14442
Crescent	82	ST*	0.2469	0.14747
		PS	0.1652	0.07254
		TT	0.1330	0.05856

\* Significant difference ( $p < 0.05$ )

**Table 2. Amount of dentifrice (grams) dispensed by 18 children using the Transverse Technique (TT), a Pea-Size Amount (PS), and the Transverse Technique (TT) with different shapes of orifices.**

Orifice shape	N	Technique	Mean	Standard Deviation
Round	18	TT*	0.3338	0.16645
		PS	0.2027	0.07494
		TT	0.2087	0.10712
Crescent	18	TT*	0.3270	0.16404
		PS	0.2032	0.07274
		TT	0.2459	0.10406

\* Significant difference ( $p < 0.05$ )

The risk of dental fluorosis has increased due to the fluoride-containing dentifrice ingestion by pre-school children. To prevent the possible over-dosage resulting in dental fluorosis, The European Academy of Pediatric Dentistry advises the use of a PS amount of 500 ppm F- dentifrices twice daily.<sup>21,22</sup> But the PS amount recommendation creates confusion.

In the study, it was observed the amount of dentifrice (with round or crescent-shaped orifice) dispensed by the children using either the ST or the TT in the first phase were within normal limits described as 0.25-0.50 gram. This amount is similar to the results described by Rock<sup>23</sup> and Bertly<sup>24</sup> where it was shown the average weight of a "PS" was equivalent to 0.3 g and 0.22g. However, at these ages this result may be related to their inability to depress the tubes because of undeveloped motor coordination rather than their acquired application technique.

When the results of the second (PS) and the third (TT) phases were evaluated, it was observed the amount of dentifrice dispensed was below the recommended dose (<0.25 g). This may be due to their suspicion about the act of pressing after the instruction and demonstration.

As a result, in several studies<sup>9,12</sup> it was reported the amount of dentifrice dispensed decreased when dentifrice tubes with smaller orifices were used. In accordance, we have found similar results with the crescent-shaped orifice. This decrease can be explained with the smaller orifice of the dentifrice tube.

An additional aspect that deserves comment is 82 children placed the dentifrice in a longitudinal direction on the bristles of the toothbrushes as in the ST. This is probably related to marketing campaigns of the manufacturers and could probably explain the quantity of dentifrice usually placed (ST) that on average proved to be high.

## Conclusion

1. Children usually preferred to use the ST rather than the TT before the instruction or demonstration by the operator.
2. A decrease was obtained with both of the round and crescent-shaped orifices, after the instruction of the PS application and demonstration of the TT in children who used the ST or the TT in the first phase ( $p < 0.05$ ).
3. The amount of dentifrice dispensed decreased generally when a dentifrice tube with a crescent-shaped orifice was used.

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