Chewing sticks, toothpaste, and plaque removal

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The aim of the present study was to assess the efficacy of brushing with chewing sticks in removing plaque and to evaluate whether toothpaste has any additional effect on the removal of established dental plaque. Kenyan schoolchildren had their plaque deposits disclosed by means of disclosing tablets and subsequently recorded on four buccal sites of all permanent teeth. The children were then allocated to two groups in a crossover design; in one group the children brushed with chewing sticks and toothpaste; the other group brushed with chewing sticks only. Substantial amounts of plaque were recorded at base line in most children. Brushing with a chewing stick for 5 min resulted in a net reduction of the proportion of plaque deposit sites per child. Toothpaste resulted in no additional effect. □ *Dental devices; home care; oral hygiene*

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Cleaning of teeth with manufactured toothbrushes is common in most industrialized countries (1, 2), whereas in many third-world countries toothbrushes are rare. Instead, locally available chewing sticks are commonly used (3–5).

The use of toothpastes has a global distribution that is rather similar to that of manufactured toothbrushes. Much attention has been paid to the effect of toothpastes as a supplement to the cleaning of teeth. Hence, highly abrasive toothpastes are more effective in the removal of stains than low-abrasive toothpastes (6, 7). The effect of toothpastes on plaque removal is more uncertain. Some investigations have indicated no additional effect on the removal of newly formed dental plaque (3, 8–10), whereas other investigators have reported such effects (11–13).

Little is known about the effect of toothpastes on the removal of long-established plaque deposits such as are commonly found in rural populations in developing countries (14). Before recommending toothpaste in such rural societies, where its cost might constitute an additional economic burden, it seems relevant to investigate how important toothpaste might be for the removal of plaque.

The aims of this study were to investigate the efficacy of the chewing stick (*mswaki*) in the removal of dental plaque and to study whether the plaque-removing capability of the chewing stick is improved by the addition of toothpaste.

Materials and methods

The study was conducted in a rural area of Machakos District, Kenya, whose social and demographic characteristics have previously been described (15). Seventy children aged 12–16 years who were habitual users of chewing sticks were selected from a school.

Each child was examined by one examiner (B. Danielsen), and the presence of plaque was recorded as follows: before examination the children chewed a disclosing tablet (Red-Cote®, Butler) for 2 min and then rinsed quickly with water twice. The buccal surfaces of all erupted permanent teeth were scored on four sites—the gingival, mesial, distal, and central—by means of the following criteria: score 0, no plaque; score 1, a thin reddish film of plaque adhering to the tooth—if only the pellicle was present, score 0 was assigned; and score 2, a distinctly red accumulation of plaque.

After the base-line examination the children were randomly assigned to one of two groups, A and B. The children in group A cleaned their teeth with the chewing stick and a small amount (sufficient to cover the end of the stick) of a medium-abrasive toothpaste (Blå Fluocalcin®, Ferrosan A/S, Denmark). The children in group B cleaned their teeth using only the chewing stick. No instructions were provided to any of the children as to how they should clean their teeth. Once the children had completed the 5-min tooth-cleaning, each child was reexamined and plaque recorded as described above.

One week later the experiment was repeated, and on this occasion those in group B used the toothpaste, while those in group A used a chewing stick only.

The children did not know when the examinations would take place, and of the 70 children who participated at the start of the experiment 48 were examined on all four occasions. The following analysis is therefore based on data from these 48 children. At all examinations plaque score 1 was only rarely observed. Plaque scores 1 and 2 have therefore been merged in all analyses. Although the present design was a crossover study, the initial data analyses showed considerable difference between the two experimental occasions. The two-sample t test (16) was therefore used to test the difference between the two groups on both occasions.

Intraexaminer reliability was assessed by double examinations of 978 sites in 9 children and showed an observed proportion agreement of 0.88, an expected proportion agreement of 0.52, and a kappa of 0.75.

Results

The cumulative frequency distributions of children in accordance with the proportion of sites per child showing plaque at the two base-line examinations are shown in Fig. 1. All children had plaque, and at least half of them had plaque on more than 60% of their sites. Ten per cent of the children had plaque on at least 90% of the sites. During the 1st week there was a tendency for the children in group A to have slightly more sites with plaque than the children in group B (Fig. 1a, Table 1), but this difference was not statistically significant ($t = 0.52$; $p > 0.60$). The children in both groups tended to have more sites with plaque at base line of the 2nd week of the experiment as compared with the 1st week ($t < 0.92$; $p > 0.30$) (Fig. 1, Table 1).

Fig. 2 shows the cumulative frequency distributions of the proportion of sites per child which had a) the same plaque score before and after brushing; b) a lower plaque score after brushing; and c) a higher plaque score after brushing for the two test pro-

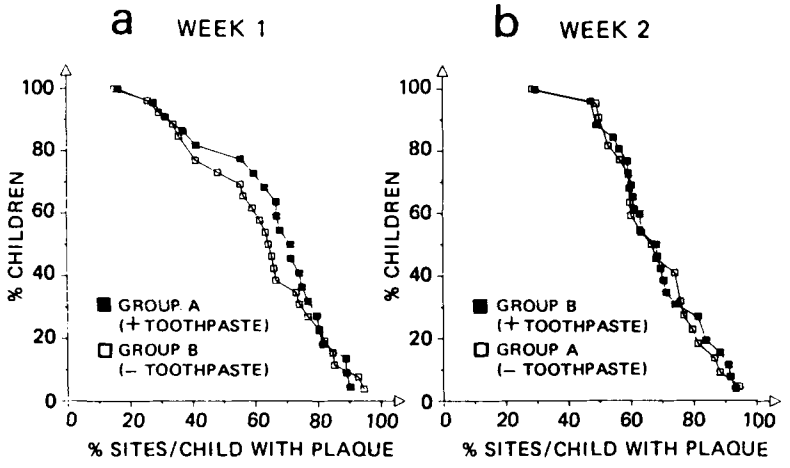

Fig. 1. The cumulative frequency distribution of children in group A (with toothpaste) and group B (without toothpaste) in accordance with the proportion of sites per child showing plaque at base line the 1st week (1a) and the cumulative frequency distribution of children in group A (without toothpaste) and group B (with toothpaste) in accordance with the proportion of sites per child showing plaque at base line the 2nd week (1b).

Table 1. The average proportion of sites with plaque per child at base line and after 5 min of brushing with a chewing stick with or without toothpaste. Group A in week 1 = chewing stick + toothpaste; group B in week 2 = chewing stick + toothpaste

		Week 1				Week 2			
		Base line		Reexam		Base line		Reexam	
	n	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD
Group A	22	64.1	21.0	42.2	19.4	67.1	15.7	39.0	22.3
Group B	26	60.3	27.7	45.0	15.9	66.1	15.6	39.2	18.4

cedures at both experiments. Irrespective of test procedure and week of experiment the most frequent observation was that of no change in the plaque scores (Fig. 2a). The brushing procedures reduced the plaque scores in all children, but only about 40–50% of the children reduced the plaque scores on more than 25% of their sites (Fig. 2b).

In the 1st week there was a tendency for those children who brushed with the addition

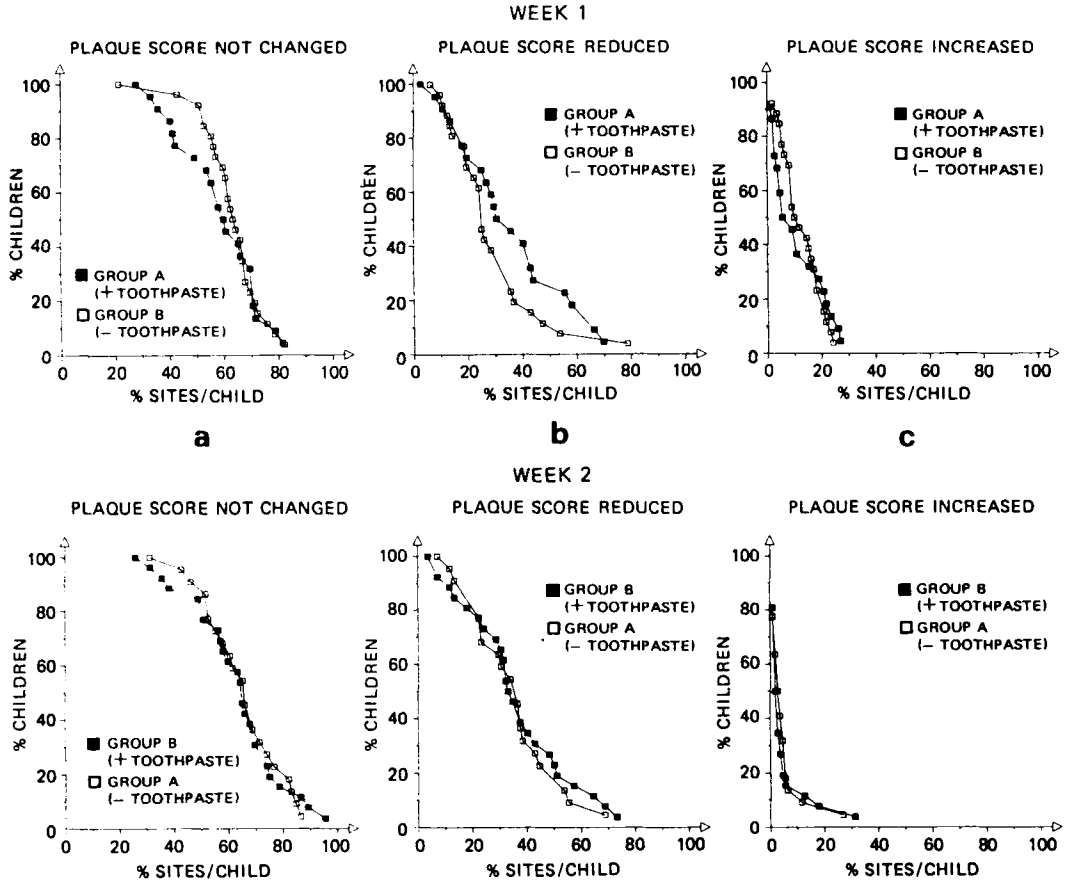

Fig. 2. The cumulative frequency distribution of children in accordance with the proportion of sites per child showing 2a) the same plaque score; 2b) a lower plaque score; and 2c) a higher plaque score after brushing with chewing stick for 5 min. The upper row denotes the 1st experimental week; the bottom row the 2nd experimental week.

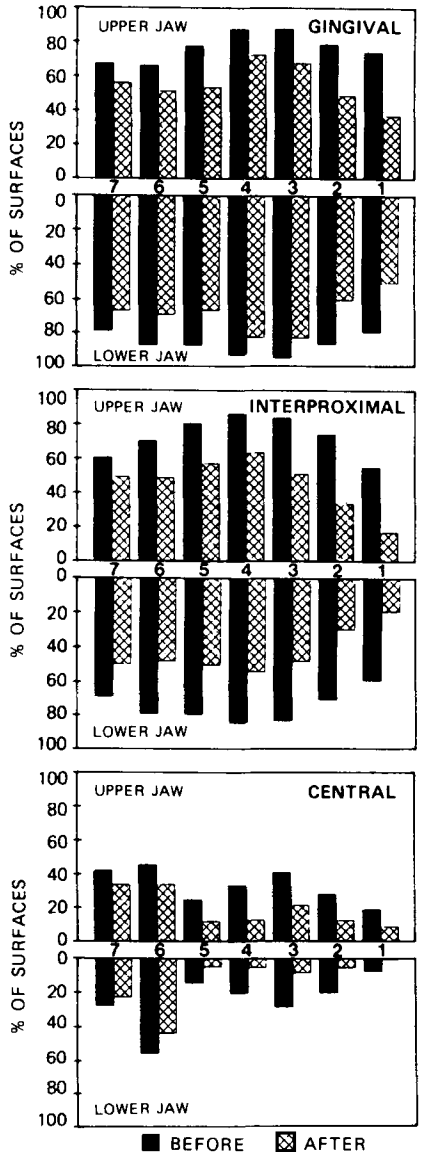

Fig. 3. The distribution of plaque at the gingival, interproximal and central sites of the buccal surfaces by type of tooth before and after 5 min of brushing with a chewing stick (all groups merged).

of toothpaste (group A) to have a higher proportion of sites with reduced plaque scores than those who brushed with chewing stick only (group B) (Fig. 2b). This difference was, however, not statistically significant ($t = 1.25, p > 0.20$) and could not be reproduced in the second experiment. The proportion of sites per child which showed an apparent increase in plaque scores was relatively small, since the majority of children had such increases on less than 10% of the sites examined (Fig. 2c). The proportion of sites per child with such increases was generally lower in the second experiment than in the first (Fig. 2c).

Table 1 shows that both brushing procedures (with or without toothpaste) led to a net reduction of the proportion of plaque sites per child in both experiments. Depending on week of experiment and procedure used, the average proportion of sites with lower plaque scores per child ranged from 15% to 28%.

The pattern of distribution of plaque before and after the experiment can be seen in Fig. 3. It is apparent that most of the interproximal and gingival sites showed plaque at base line. Premolars were the teeth most frequently showing plaque deposits both before and after brushing. Fig. 3 also demonstrates that plaque removal was greater in anterior than in posterior teeth.

Discussion

The present results indicate that Kenyan children who are habitual users of chewing sticks are able to remove plaque without being instructed in how to use the chewing stick most efficiently. The plaque removal observed was not large, but taking into account that no instructions were given, it seems reasonable to assume that such instructions may lead to a much higher degree of plaque removal, as shown in rural Ethiopian children (5).

In the present study the chewing stick removed plaque from interproximal sites to virtually the same extent as for the gingival and central sites. In this respect the chewing stick seems more efficient than the ordinary toothbrush, which has been reported to be a poor tool for the removal of interproximal plaque (17–19). Although this difference could be a result of lower plaque levels in the study populations who used the ordinary toothbrushes (17–19), it should be recognized that the chewing stick, when used

properly, has the quality of a single-tufted brush. In the hands of Sri Lankan dental students, however, the chewing stick was not as effective as the ordinary toothbrush (4), whereas among rural Ethiopian schoolchildren no difference was seen (5).

Twenty-two children dropped out of our investigation. Since the children were not aware of when the examinations would take place, there seems no reason to fear bias due to this.

The addition of toothpaste to brushing with a chewing stick did not improve removal of plaque. For developing countries, where toothpastes may be relatively expensive in relation to the purchasing power of rural populations, the present study indicates that it may not be justifiable to recommend the use of toothpaste merely for plaque removal purposes. Moreover, since the effect of toothpastes on newly formed dental plaque or on recolonization of tooth surfaces seems controversial (4, 8–13), and considering that the plaque deposits encountered in most developing countries usually comprise rather old and established plaque deposits such as those seen in the present study, it seems reasonable to conclude that there are limited arguments for introducing toothpastes to such populations for assisting in plaque removal.

Having stated this, we recognize, however, that toothpastes do constitute important vehicles for topical fluorides and for antimicrobial agents, and their promotion may be justified for such purposes. Before recommending the introduction of toothpastes, however, it seems to us important that the efficacy of the toothpastes can be demonstrated for the populations in question.

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