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Evaluation of toothbrush bristles' deterioration used by preschool children

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Abstract: The toothbrush is an effective instrument for oral diseases prevention. The flexibility and status of bristles, as well as the size of the handle are fundamental for an effective toothbrushing. Thus, the assessment of physical characteristics of toothbrushes is important. This study evaluated the deterioration and wear of bristles of toothbrushes used by preschool children. For the sample selection, five elementary schools were assorted from a city of the São Paulo State northwest region, one from each city area. All toothbrushes used by preschool children who aged between 5 and 6 years old and who attended the assorted schools were visually analysed by two calibrated examiners, according to the criteria proposed by Rawls HR, Mkwayi-Tulloch NJ, Casella R, Cosgrove R (J Dent Res 1989; 12:1781): 0 - it is impossible to state if the toothbrush was used or not; 1 - the bristles seem to be separated within some tufts; 2 - most tufts are separated, many cover other tufts and present a large number of curved and inclined bristles; 3 - most tufts are covered by others and bristles are folded and tipped. In total, 333 toothbrushes were evaluated. The data obtained revealed that 57.96% of the toothbrushes presented adequate condition for utilization (scores 0 and 1), whereas 42.04% presented inadequate bristles for their function (scores 2 and 3). It was concluded that a great number of toothbrushes presented deterioration of the bristles. Thus, there is the need to guide and promote awareness among teachers, parents and children as well as the need to replace toothbrushes.

Key words: health promotion; preschool children; toothbrushes

Introduction

Oral hygiene, fluoride use and dietary control are effective preventive measures for the control of caries and periodontal disease (1). The mechanical approaches have the purpose of plaque removal, contributing to the control of oral diseases, being safer and efficient (2–5). Among all dentistry devices developed for oral hygiene, none of them reaches a high level of bacterial dental plaque removal, with the exception to the toothbrush (6).

Considering that the toothbrush is an instrument employed for dental plaque control and is a universally accepted method for the prevention of these diseases, the assessment of toothbrushes is important (7). The physical requirements of toothbrushes, the technique employed, the child's ability, as well as the progressive wear of bristles by utilization of the toothbrush are essential for the evaluation of toothbrushing efficacy (8–11).

Studies show that the progressive wear of the bristles caused by the toothbrush use interferes in the bacterial dental plaque removal, because during its utilization, the bristles become thin and are worn down near to its tips, becoming easily bent and curled (10, 12–14).

It is known that dentists generally recommend their patients to change their toothbrushes after three months of use (15, 16). However, it has been shown that the toothbrushes ability to remove bacterial plaque is significantly reduced about 6 weeks of use (10). Thus, the toothbrushes change cannot be based upon the period of use, which varies from patient to patient. In this way, patients should therefore be encouraged to replace their toothbrush regularly before bristle wear becomes excessive (11).

In 1989, Rawls *et al.* (17) elaborated an index to judge the toothbrushes wear and deterioration; thus, the purpose of this study was to evaluate, through this index, the overall conservation state of the toothbrushes used by preschool children, which have the dental brushing as a daily routine in the school they attend.

Methods

This study was approved by the Institutional Review Board of Araçatuba Dental School, São Paulo State University, Brazil. A pilot study was conducted to test the instrument employed and to calibrate two investigators.

For the sample selection, five elementary schools were randomly assorted from the city of Araçatuba, São Paulo State, Brazil, one from each city area (north, south, east, west and central). This means that all elementary schools had the same chance to take part in this research.

After assorting the schools, we evaluated the toothbrushes used by preschool children of both genders aged between 5 and 6 years old attending these schools. Evaluation of the bristles' condition of the toothbrushes used by preschool children was performed by observation and scoring according to the index proposed by Rawls *et al.* (17), as demonstrated in Table 1.

Toothbrushes were visually evaluated by two dentists properly calibrated for this exam. A training of three researchers was conducted using different models of toothbrushes covering all classifications proposed by Rawls. The choice of the two examiners was obtained by inter-examiner agreement, as evidenced by the Kappa statistical test, with a value of 0.89, which was considered satisfactory.

The scale is composed of a series of four numbers in increasing order from 0 to 3. Each number is followed by a description and an image of the morphological aspects of toothbrush bristles corresponding to the scores, to improve the classification (Fig. 1).

Table 1. Index proposed by Rawls et al. (17)

Score	Appearance of toothbrush
0	It is impossible to state if the toothbrush was used or not
1	The bristles seem to be separated within some tufts
2	Most tufts are separated, many cover other tufts and present a large number of curved and inclined bristles
3	Most tufts are covered by others and bristles are folded and tipped



Fig. 1. Pattern of utilization. Legend: 0 – new; 1 – little utilization; 2 – medium utilization; 3 – high utilization.



Fig. 2. Percentage distribution of toothbrushes according to the index proposed by Rawls, Araçatuba, SP/Brazil. 2008.

Results

The amount of toothbrushes evaluated was 333. The data collected (Fig. 2) revealed that 30.03% of the toothbrush bristles presented a score of 0 and 27.93% exhibited a score of 1, thus adding up to 57.96% of toothbrushes with proper condition for utilization. However, 19.52% presented with most tufts separated, often covering other tufts and with a larger number of curved and inclined bristles, classified as the stage of replacement, i.e. score 2. Also, 22.52% presented improper condition for its function, i.e. score 3.

Discussion

The mechanical means for plaque control are the safest and most effective; among these, a toothbrush utilization is the method of choice for oral hygiene promotion. It is also used for application of preventive agents such as fluorides (18).

Usually, many public preschools adopt supervised toothbrushing among children as a routine practice. Attin and Hornecker (19), in 2005, highlighted that careful toothbrushing, related to the time and technique of brushing, once a day was enough to support oral health and prevent caries and periodontal disease (5). According to Sidder (20), in 2008, the key element to brushing is the ability to concentrate on the brushing. Considering that many children perform toothbrushing only at the schools, toothbrushes should present proper condition for utilization.

Many factors may contribute to the appearance of heterogeneous wear during utilization of toothbrushes, such as individual differences in utilization, variation in materials employed for their fabrication, design and others (21, 22). Thus, the progressive wear of toothbrush bristles may impair the ability of tooth cleaning during toothbrushing (21, 23).

The result observed in this study demonstrated that a large number of toothbrushes (42.04%) presented deteriorated bristles (scores 2 and 3). Terreri *et al.* (24) conducted a similar study at the same city in 1999 following the same criteria for wear evaluation of the toothbrush bristles and found that 78.12% of toothbrushes were inadequate for utilization. The need for replacement of toothbrushes is remarkable. Failure to observe the deterioration of toothbrush bristles may impair the oral hygiene performed at schools.

According to Kreifeldt *et al.* (6), in 1980, the criterion employed for replacement of toothbrushes was the wear of bristles, regardless of the period of utilization. Thus, the protocol for replacement of toothbrushes should be revisited. Further, the toothbrush bristles become worn, the surface area to which microorganisms adhere increases (25).

The results of this study may provide information to students within the oral health professions and professionals themselves related to the implementation of preschool educational programmes. There appears to be a need to promote the awareness of parents and teachers regarding the replacement of worn toothbrushes. Considering the lack of studies on this issue, further investigations should be performed to support a change in behaviour related to the replacement of toothbrushes.

Conclusion

1 A high number of toothbrushes analysed presented bristles with improper condition for utilization.

2 There is the need to promote awareness of the importance of the quality of toothbrush bristles for removal of dental plaque.

3 Oral health professionals should emphasize to teachers, parents and children in preschools the criteria for toothbrush replacement.

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