The influence of tooth brushing supervision on the dental plaque index and toothbrush wear in preschool children

A influência da supervisão de escovação no índice de placa dental e desgaste de escovas infantis

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Resumo

Objetivo: Avaliar a efetividade da supervisão de escovação em uma ou mais sessões na remoção de placa dental e desgaste de escovas. **Material e método:** Crianças de 3 a 5 anos de idade receberam escovas dentais novas e participaram de um teatro de fantoches sobre saúde bucal. Foram selecionadas 49 e distribuídas aleatoriamente em três grupos (GI=20; GII=14 e GIII=14). A técnica de Fones foi demonstrada aos grupos GI e GII para avaliar:a supervisão profissional direta e o treinamento de escovação em cinco sessões (GI), a supervisão profissional direta e o treinamento em uma única sessão (GII) e a influência do teatro de fantoches (GIII-grupo controle). Os índices de placa dental (IPL) foram registrados no início do estudo (T0), após 24 dias (T1) e 46 dias (T2) e os índices de desgaste das escovas dentais (ID) no T1 e T2. Os testes de Kruskal-Wallis e Friedman (IPL); ANOVA de um critério e o teste t de Student (ID) (p<0,05) foram empregados na análise dos dados. **Resultado:** O GI diferiu de forma significativa dos outros grupos no T1 e T2 (p<0,01). O índice de desgaste das escovas aumentou (p<0,0001) dos 24 dias (0,52±0,35mm) para os 46 dias (0,90±0,48mm) e não houve associação significativa entre desgaste de escova e índice de placa, tanto em T1 (r=0,230-p= 0,116), quanto em T2 (r=0.226-p=0,121). **Conclusão:** A supervisão profissional em sessões múltiplas foi efetiva para reduzir os índices de placa, os quais não foram influenciados pelo desgaste das escovas, mostrando a necessidade de contínua motivação em higiene bucal.

Descritores: Escovação dentária; placa dental; pré-escolar.

Abstract

Objective: To evaluate the effectiveness of tooth brushing supervision in one or more sessions on dental plaque removal and toothbrush wear. **Material and method**: 3- to 5-year-old children received new toothbrushes and attended a puppet theater about oral health. Forty-nine children were randomly selected and divided into 3 groups (GI=20; GII=14; GIII=14). Fones' brushing method was demonstrated to the GI and GII groups to evaluate the following: the professional direct supervision and tooth brushing training in five sessions (GI), the professional direct supervision and a one-training session (GII) and the puppet theater influence only (GIII—control group). The dental plaque index (IPL) was recorded at baseline (T0), after 24 days (T1) and after 46 days (T2) and toothbrush wear (ID) was recorded on T1 and T2. The Kruskal-Wallis test and the Friedman test (IPL), as well as the one-way ANOVA and the paired Student's t-test (ID) (p<0.05) were employed to analyze the data. **Result**: GI showed a significant difference from the others groups in T1 and T2 (p<0.01).The index of toothbrush wear increased (p<0.0001) from 24 days (0.52±0.35mm) to 46 days (0.90±0.48mm), but there was no significant association between toothbrush wear and plaque index for T1 (r=0.230-p= 0.116) as well as for T2 (r=0.226-p=0.121). **Conclusion**: The multiple sessions of professional supervision were effective to reduce the dental plaque index, which was not influenced by toothbrush wear, showing continuous oral hygiene motivation needs.

Descriptors: Tooth brushing; dental plaque; child, preschool.

INTRODUCTION

The control of dental biofilm is an essential measure in preventing dental caries and periodontal disease. However, even with this knowledge, there are many people who do not regularly use a toothbrush and dental floss regularly. This is especially true for children, since they depend on their parents or caregivers to carry out or supervise oral hygiene[1-4]. In some localities, there is a high percentage of schoolchildren who do not have toothbrushes or share the same toothbrush with other members of their family[5].

The school is an appropriate place to put oral health programs into practice, since the students are at a favorable age

to participate in educational and preventive programs in order to achieve healthy habits and avoid or decrease the incidence of oral diseases[4,6].

A study conducted in Scotland showed that 5-year-old children had a decrease in dental caries index after a national health program was implemented in kindergartens. This program's actions were supervised tooth brushing and the distribution of fluoride toothpaste and toothbrushes for home use[7].

The effective control of dental plaque depends on two fundamental conditions: the presence of appropriate hygiene devices and the proper use of them, which will be possible after motivation, instruction and individual training[3]. The toothbrush is the most important tool for oral hygiene, but it doesn't receive all the attention it needs. Usually, the form of storage is not suitable and the toothbrush remains in use even when it has deformed bristles[8-11]. In developing countries, the cost of changing toothbrushes at regular periods may be prohibitive[12]. On the other hand, the effectiveness of a toothbrush on removing dental plaque is dependent upon the correct position of its bristles. Toothbrushes can deform in different ways as a result of pressing the bristles against the teeth; therefore, the contact of the bristles around cervical margins will not be possible[8].

Systematic reviews using educational brochures and flyers from ten different countries showed that some of the basic practices of oral health recommended to the population are inconsistent and are not based in scientific evidence[13]. The information for children included frequency, technique and the time spend to brush their teeth, as well as toothbrush models.

This paper started from the assumption that positive modifications in plaque index and in toothbrush bristles could occur with professional supervision, since some children do not use their toothbrushes properly and, therefore, do not adequately remove plaque[8,9]. Therefore, the aim of this research was to evaluate the effect of orientation and professional supervision of children tooth brushing in single or multiple sessions regarding plaque index and toothbrush wear.

MATERIAL AND METHOD

1. Study Approval

This research was approved by the Ethics Committee on Human Beings Research from Ponta Grossa State University (Ponta Grossa, Paraná, Brazil), under protocol # 1873/2007. The Bureau of Education from Ponta Grossa city also authorized the execution of this research. The choice of the kindergarten considered the number of pre-school children enrolled and the interest the school staff demonstrated in joining the research.

2. Sample Selection

Children from 3 to 5 years old, of both genders, who attended the São Judas Tadeu kindergarten in Ponta Grossa, Paraná, Brazil, took part in this research. The inclusion criteria were complete primary dentition and normal motor and cognitive development.

Children with large cavities and/or endodontic problems, as well as early loss of deciduous teeth or orthodontic problems that could interfere with tooth brushing patterns, were excluded. After clinical exam, 49 children were selected. Their parents were informed about the research objectives and signed a consent form.

3. Study Design

Three experimental conditions were evaluated: direct supervision/tooth brushing coaching in 5 sessions (GI); tooth brushing coaching in one session (GII) and only a puppet show (GIII). Two evaluation parameters were included: dental plaque index (PI) and toothbrush wear index (WI).

The plaque index was registered 3 times: before the children attended the puppet show (baseline – T0), after 24 days (T1) and after 46 days (T2). The toothbrush bristles were measured after 24 and 46 days of use in order to obtain the wear index.

In the first stage of the research, all the children enrolled in the kindergarten attended a puppet show. The objective of this activity was to orient them to the importance of oral health. Using an appropriate speech that the children could understand, the researchers emphasized general concepts like the need for daily tooth brushing and the cariogenic potential of the food. Tooth brushing techniques or detailed instructions were not presented. The teachers and caregivers also attended this activity. The researchers were at the children's and teacher's disposal to clarify all the doubts after the puppet show.

In the second stage of the research, children were divided randomly into three groups: GI (n=20); GII (n=14) and GIII (n=14). Children in GI were further divided into groups of 5 to facilitate the teaching and training of the chosen tooth brushing technique, which was accomplished in two consecutive weeks (Monday/Wednesday/Friday and Monday/Wednesday). The Fones tooth brushing technique was demonstrated using macro-models of the dental arches and toothbrushes. Children were encouraged to repeat the movements with the help of the researchers. This procedure was repeated five times, in sessions of 15 minutes for the groups of 5 children. For GII, the Fones technique was demonstrated in the same way, but there was only one training session. During training, we did not use toothpaste to avoid distraction when children practiced spitting. GIII (control group) consisted of children who attended the puppet show, but they did not receive formal instructions and toothbrush training.

The plaque index (PI) was registered in the three evaluation times according to Simplified Oral Hygiene Index from Greene, Vermillion,[14] which was modified for this research. We examined the following deciduous teeth: 55, 51, 61, 65, 85, 81, 71 and 75. The quantity of dental plaque was recorded according these scores: 0 – absence of plaque or stains; 1 – presence of plaque covering no more than 1/3 of the examined surface; 2 – presence of plaque covering more than 1/3, but no more than 2/3 of the examined surface; 3 – presence of plaque covering more than 2/3 of the examined surface. A plaque disclosing agent was used to make this exam possible (Replak, Dentisply, Petrópolis, Rio de Janeiro, Brazil).

The children's toothbrushes (Sanifill UP 26, extra soft) from the three groups were identified and stored in the kindergarten. They were used only for research purposes, once a day, after lunchtime.

The wear of the bristles (the changes in the tuft alignment) was evaluated after 24 and 46 days of use. The deformation of the bristles was measured using a digital pachymeter (Vernier Calipers 150 × 0.05 mm) and the wear index (WI) was registered according to the equation developed by Rawls et al.[15] and adapted by Sforza et al.[16] (Figure 1).

The data were collected by only one researcher, who was trained and calibrated to register the indices of dental plaque and toothbrush wear. For this purpose, the dental plaque index was evaluated in seven children not included in the sample and the wear index was measured in ten worn toothbrushes before the beginning of this research. There was good intraexaminer agreement (PI – Kappa=0.92; WI – interclass correlation=0.87). The researcher was blind to the study group during all evaluation periods.

4. Statistical Analysis

The comparison of PI between groups was accomplished for each evaluation time (T0, T1 and T2) separately using the Kruskal-Wallis test. The Friedman test was used for the IP analysis in the same group and at different times (T0, T1 and T2). Multiple comparisons were done with the Dunn post-test.

The WI of the toothbrushes in T1 and T2 was compared using the paired Student's t-test. One-criterion ANOVA was used for the comparison between groups in different times (T1 and T2). The association between WI and PI was verified using Spearman's correlation coefficient.

All tests used a level of significance of 5%. The statistical software used included GraphPadPrism version 3.00 for Windows, GraphPad Software (San Diego California USA) and SPSS 13.0 for Windows (SPSS INC, Chicago, Illinois USA).

RESULT

The final sample consisted of 48 children, consisting of 19 children from GI, 14 from GII and 14 from GIII. One child from GI failed two training sessions and was excluded from the study.

GI showed significant differences in booth evaluation periods (p<0.01). No differences were observed for GII and GIII (p>0.05).

In GI, there was a significant decrease in PI from T0 to TI (p<0.01), and it remained steady in T2 (p>0.05). In GII, the reduction in PI was significant from T0 to T1, but increased from T1 to T2 (p>0.05). No differences were detected between T0 and T2 (Figure 2).

The WI increased from T1 (0.52±0.35mm) to T2 (0.90±0.48mm) (p<0.0001) (Figure 3).

There was no significant association between toothbrush wear and dental plaque index for T1 (r=0.230-p= 0.116) and T2 (r=0.226-p=0.121) (Figure 4).

DISCUSSION

The different strategies for patient motivation and the quality of oral hygiene devices should be evaluated,[1,3,8,10,13] since plaque control is a fundamental measure to reduce and control oral diseases that are plaque-dependent. In this research, pre-school children were oriented about oral hygiene in a group with a puppet show and took part in tooth brushing training in one or multiple sessions. Before any intervention, the quantity of dental plaque detected was similar for all study groups. This situation modified during the research, since in the 24-day (T1) and 46-day (T2) evaluation periods, significant differences were observed in the groups.
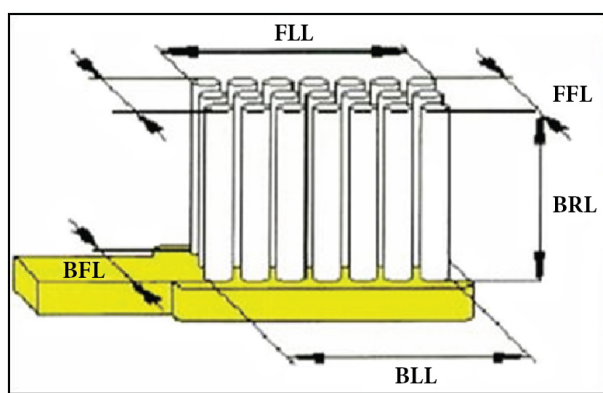

$$WI = \frac{(FLL - BLL + FFL - BFL)}{BRL}$$

WI = Wear index
BLL = lateral length at base
FLL = free lateral length
BFL = frontal length at base
FFL = free frontal length
BRL = bristle's length

Figure 1. Measures obtained from toothbrushes (Sforza et al.[16], 2000) and equation preconized by Rawls et al.[15] (1989).
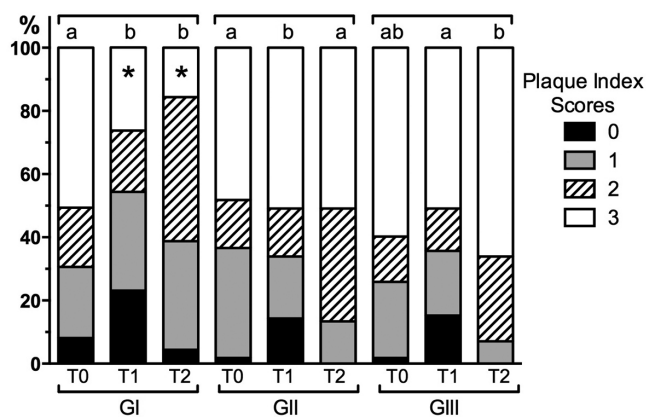
Figure 2. Relative frequency of PI scores in different groups and evaluation times. Group comparison in T0, T1 and T2: *$p<0,01$ with GII and GIII (Kruskal- Wallis test and Dunn's post-test). Time comparison intragroup: different letters indicate statistical differences ($p<0.05$) (Friedman's test and Dunn's post test).
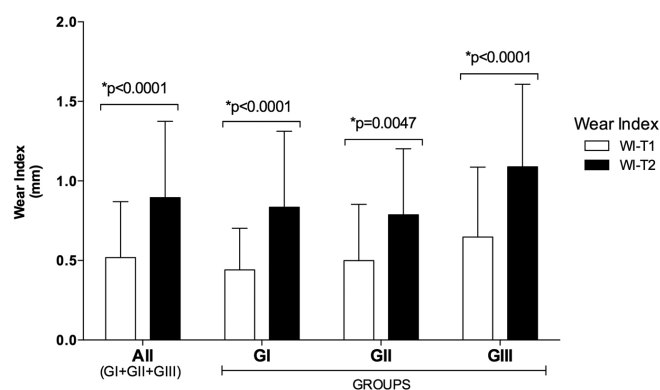
Figure 3. Mean and standard deviation of toothbrush wear in different groups and evaluation times. Comparison between T1 and T2 showed significant differences (* paired Student's t test). No significant differences were observed between groups in T1 ($p=0.2370$) and T2 ($p=0.1932$)
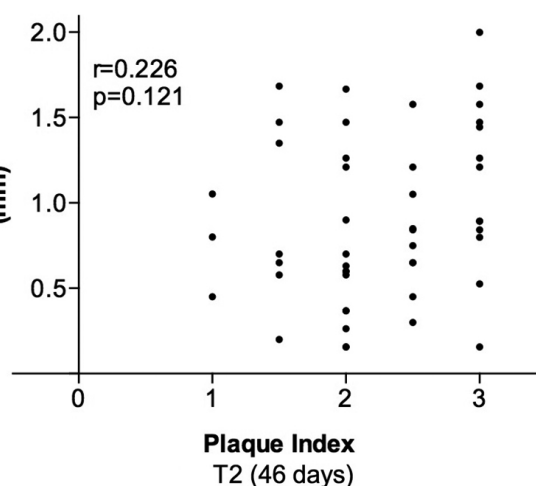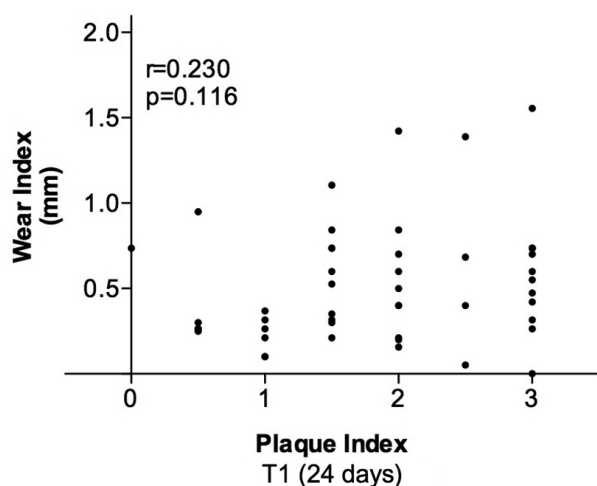
No differences were detected in GII (puppet show + single session training) and GIII (puppet show) for T1 and T2. However, GI (puppet show + direct supervision + five training sessions) showed differences. This fact demonstrates that multiple sessions are needed in order to achieve a significant reduction on plaque index. An educational lecture or single session supervision resulted in similar outcomes that were insufficient to improve dental plaque index over time.

The analysis of PI in GI in the different evaluation times showed significant differences, which were detected from T0 to T1 and T2, but the same did not occur from T1 to T2. Therefore we believe that the five training sessions resulted in a reduction of PI from T0 to T1 and that reduction was stable in T2. In the other groups, a discreet decrease in PI from T0 to T1 was observed, with variations on the registered scores. In GII, T1 was different from T0 and T2 and in GIII, the difference was noted between T1 and T2. These results suggest that the lecture and one single session of oral hygiene instruction resulted in an initial reduction, but this decrease in PI was not sustained as occurred in GI.

In GI, the sample had more children than other groups, since a dropout was expected due to student absences or difficulty executing the correct movements during tooth brushing. But this fact was not confirmed, since there was only one exclusion caused by non-attendance.

The direct supervision in five sessions was more effective in reducing PI and had already been showed by other researchers,[17,18] who verified that a single session of tooth brushing instructions did not significantly affect oral hygiene significantly.

Indeed, tooth brushing for children under 10 years of age may be ineffective due to low manual dexterity and lack of motivation[2]. That's why the help and supervision of an adult are recommended at this age. However, only 34% of the children receive the necessary supervision[4].

Therefore, different motivation techniques may be used to motivate the patients, including audiovisual techniques, child modeling or individual instruction. Among them, individual

Figure 4. Association between Wear Index (mm) and Plaque Index (median). Values corresponding to T1 (A) and T2 (B). Non significant association (Spearman's correlation coefficient)

instruction is still the most effective to reduce dental plaque in preschool children;[19] and, when associated with dental-themed toys, the decrease in the dental plaque index may be even bigger[20]. Different toothbrushes (manual and electric) have already been tested, including devices for child motivation,[3] but the dental plaque reduction was higher when the tooth brushing was supervised. This showed that direct supervision is more important than the kind of toothbrush employed[18].

During the process, the most important is that the instructions must be delivered to the children according to their cognitive capacity and development stage.[1] Only in this way will the child understand the importance of this procedure to his/her oral health. This study makes evident the need for training and constant motivation.

On the other side, positive outcomes will probably occur with the use of suitable devices. Therefore, the storage and wear of the toothbrushes must also be evaluated.

Toothbrushes that are stored properly may last longer,[21] and the bacterial contamination in the bristles caused by the contact between toothbrushes or by the environment may be reduced[22]. Previous studies[8,9] carried out in kindergartens in the same city in which this research was conducted revealed the practice of unsupervised oral hygiene procedures and inappropriate storage and use of toothbrushes. This fact showed the need for instructions about oral hygiene and the importance of tooth brushing supervision, both subjects that were addressed by this research in the initial lecture by using puppets for the children, teachers and caregivers.

It was observed that toothbrush wear increased between T1 and T2, in the three groups. The statistical analysis showed a trend of higher wear in GIII toothbrushes, but no statistical differences were detected. Therefore, toothbrush wear was not associated with supervision in one or more sessions. The relationship between toothbrush wear and plaque index was not verified either.

The classic research by Rawls et al.[15] clarified that the period of use, the user and the composition of the bristles have stronger influence over the wear index of the toothbrushes than their model. This was confirmed by Stroski et al.,[23] who showed that bristle arrangement has little influence in dental plaque removal and gingival health in preschool children.

The literature lacks total agreement; nevertheless, toothbrush replacement must occur after a period of 3 months in use[15,23]. We used shorter evaluation periods (24 and 46) days to make the end of this research possible before the students went on vacation.

In general, evaluation periods are from 30 to 60 days[24]. Besides, the daily use of the toothbrushes in this study (once a day) does not reflect typical toothbrush use (three times a day). This is because the toothbrushes were stored in school and were not used at home. It's important to remember that other factors can contribute to the wear of toothbrush bristles, such as the way the toothbrush is handled, the pressure during tooth brushing and the quality of the bristle material[15,23].

CONCLUSION

The dental plaque index was reduced after professional supervision in multiple sessions and it was not influenced by the wear of the toothbrush bristles, which showed the need for continuous motivation in pediatric oral hygiene.

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CONFLICTS OF INTERESTS

The authors declare no conflicts of interest.

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