DENTAL BIOFILM REMOVING EFFECTIVENESS OF SILICONE AND CONVENTIONAL TOOTHBRUSHES

ESTUDO DA EFETIVIDADE DAS ESCOVAS DE SILICONE E CONVENCIONAL NA REMOÇÃO DO BIOFILME DENTÁRIO

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Summary

The aim of this study was to compare the dental biofilm removal effectiveness of silicone and conventional toothbrushes. At total, 37 volunteers were assigned to 2 groups: dental and non-dental students. Volunteers abstained from toothbrushing 12 hours prior to the examination. The measurement of dental biofilm accumulated on dental surface was accessed using the O'Leary index. For scoring, sixteen standardised teeth of each volunteer were analyzed before and after toothbrushing. The same volunteers brushed their teeth using silicone and conventional toothbrushes at different examinations. In the present study, the efficacy of dental biofilm removal of both silicone and conventional toothbrushes was similar ($p > 0,05$).

***UNITERMS**: TOOTHBRUSHING – SILICONE TOOTHBRUSH – CONVENTIONAL TOOTHBRUSH – DENTAL BIOFILMS.*

Resumo

O objetivo deste estudo foi comparar a eficácia de remoção do biofilme dental entre escovas de silicone e convencional. Participaram 37 voluntários, divididos em dois grupos, estudantes odontólogos e não odontólogos. Os participantes deixaram de promover a limpeza dos dentes 12 horas antes do exame clínico específico. Para a quantificação do biofilme dentário, albergado na superfície dos dentes, foi utilizado o Índice de O'Leary. Para a pontuação foram utilizados 16 dentes padrões para cada participante, antes e após a escovação. Os mesmos participantes escovaram os dentes em dois exames diferentes, utilizando escovas de silicone ou convencional. Como resultado, obteve-se uma eficácia de remoção de biofilme dental similar ($p > 0,05$) entre escovas de silicone e convencional.

***KEYWORDS**: ESCOVAÇÃO DENTÁRIA – ESCOVA DE SILICONE – ESCOVA CONVENCIONAL – BIOFILME DENTÁRIO.*

Introduction

Dental biofilms are "the soft tenacious material found on tooth surfaces which is not readily removed by rinsing with water".[7] Dental biofilms, with other factors such as the host and diet, are main factors involved in the etiology of dental caries.[25]

Several clinical studies provide evidence that prevention of gingivitis and periimplantitis are also related to controlled dental biofilms along the gingival margins of teeth or implants.[1, 13, 15, 22]

The first option for the control of dental biofilms is mechanical. Chemical control is associated to mechanical control only when mechanical control proves to be ineffective.[20]

Toothbrushes remain as a major instrument for personal oral hygiene. Since the introduction of the electric toothbrush devices, it has become established as an alternative to manual methods of toothbrushing.[3, 21] However, several undesired effects such as gingival abrasion, dental abrasion and gingival recession have been reported due to wrong toothbrushing techniques, too much strength exerted in brushing, overbrushing, and usage of hard toothbrush bristles.[4, 11, 12, 19, 26] In view of these possible problems, a softer silicone bristle was developed.

The aim of this study was to compare the effectiveness of silicone and conventional toothbrushes in plaque removal.

Materials and Methods

All the methodology of this study was approved by the Ethical Committee of Human Research from the Dentistry School of Ribeirão Preto. Thirty-seven volunteers between ages 19 and 24 participated in this single-use study. Volunteers were divided into two groups: a) twenty dental and b) seventeen non-dental students from the University of São Paulo (USP). All volunteers were free of major oral hard and soft-tissue lesions and none were in active orthodontic treatment during the study. Subjects were excluded if during the preceding three months they had taken antibiotics, corticosteroids, or immunosuppressives or had used nonsteroidal anti-inflammatory agents regularly. All volunteers were dentate and had no oral prosthesis appliances, with a minimum of 22 scorable teeth.

At the first appointment, all subjects signed a written consent and were instructed on the standardised modified-Bass toothbrushing technique.[2]

Volunteers reported to the clinic with a minimum of 12 hours of undisturbed plaque. All clinical examinations were performed by the same examiner. Volunteers were instructed not to reveal their brush assignment to the clinical examiner. Biofilms were disclosed with 0.5% basic fucsine solution and a pre-brushing plaque index was recorded using the O'Leary plaque index.[19] The buccal and lingual surfaces of 16 teeth (4 teeth of each quadrant) were evaluated as following: central incisors, canines, first premolars and first molars. Following the pre-brushing examination, subjects were provided with a nylon toothbrush (Oral B® Advantage®, Oral-B Laboratories, Boston, MA, USA) and 5 mm of dentifrice. Each subject was instructed to brush according to the modified Bass toothbrushing method and timed brushing was performed for 2 minutes. The post-brushing plaque index was recorded and all the subjects returned one week later for the same procedure using silicone toothbrush (model 111, Jefe Inc., Seoul, South Korea).

The data were computerized for analysis, which was carried out using GMC 8.1 software (Ribeirão Preto, Brazil). Paired comparisons by the Wilcoxon signed rank test was performed on pre- and post-brushing values.

Results

Table 1 lists the mean pre- and post-brushing scores using silicone toothbrushes. There were no significant differences between dental and non-dental students ($p > 0,05$) regarding plaque removal efficacy. However, there were statistically significant differences ($p < 0,05$) between dental and non-dental students using control toothbrushes (tab. 2). The total outcomes of dental and non-dental students were mixed together to analyse the mean pre- and post-brushing plaque index scores between silicone and control toothbrushes (tab. 3). The results demonstrated similar plaque removal for both toothbrushes ($p > 0,05$).

Discussion

Effective oral hygiene prevents the production of acids and eliminates the possibility of enamel decalcification. Several devices for mechanical oral hygiene with different materials and designs have been developed. The modification of filament shape, bristle-end, head shape, bristle lengths have been improving the plaque removal efficacy.[29]

Table 1. Mean pre- and post-brushing O'Leary plaque index scores of dental students, non-dental students with % reductions using silicone toothbrush.

Group	Pre	Post	% reduction
Dental students	1.94 (1.04)	0.38 (0.59)	80.4
Non-dental students*	2.25 (1.15)	0.66 (1.04)	70.7

** Non-significant differences between groups, p > 0,05.*

Table 2. Mean pre- and post-brushing O'Leary plaque index scores of dental students, non-dental students with % reductions using control toothbrush.

Group	Pre	Post	% reduction
Dental students	1.70 (0.99)	0.34 (0.60)	80.0
Non-dental students **	2.22 (1.01)	0.34 (0.62)	84.7

*** Statistically significant differences between groups, p < 0,05.*

Table 3. Mean pre- and post-brushing O'Leary plaque index scores of silicone and control toothbrushes with % reductions.

Group	Pre	Post	% reduction
Silicone	2.09 (1.11)	0.50 (0.83)	76.1
Control*	1.95 (1.03)	0.34 (0.61)	82.6

** Non-significant differences between groups, p > 0,05.*

Within these advances, battery-powered toothbrushes have gained special attention as personal hygiene device. However there are studies questioning its abrasiveness, especially when there is lack of control of the brushing frequency and force.[6] This same author also studied the damaging effect of toothbrush bristle-end form on the gingiva and concluded that the straight cut bristle ends were more damaging than rounded ends. Later studies have proposed modification of bristles such as tapered and round end.[1]

In view of these findings, a new silicone bristle toothbrush has been developed with soft and round end bristle.

In this single-use study, we compared the dental biofilm removing effectiveness using silicone and conventional toothbrushes. The results of this clinical study demonstrated that both the silicone toothbrush and the conventional nylon toothbrush are capable of removing supragingival dental biofilms. Since the usage of hard toothbrush bristles is related to tooth abrasion, the softness of the silicone bristles may represent less potential to cause undesired effects due to the wrong toothbrushing technique previously discussed.

In contrast to the majority of the literature that show a greater biofilm removal through the use of electric toothbrushes, studies from the University of Bern showed interesting results when dental students volunteered for the study.[16] The plaque reducing effect was similar between manual and electric toothbrushes. Other studies also support the importance of educational and training programs for toothbrushing effectiveness.[14, 28] So, dental students are expected to demonstrate greater biofilm reduction by toothbrushing. However, non-dental students demonstrated higher dental biofilm removal scores, with statistically significant difference ($p < 0,05$), compared to dental students using conventional toothbrushes. That seems to be the result of a higher amount of pre-brushing plaque of the non-dental student group rather than more efficient clinical dental biofilm removal realized by this group.

Several authors have reported toothbrush contamination.[8, 24, 27] Toothbrushes are colo-

Picture 1. The brushhead design of silicone toothbrush.

nized by oral cavity microbiota which can act as reservoirs to reintroduce microorganisms that contaminate unaffected surfaces.[23] Caurdry *et al.* reported that contaminated bristles may play an important role in the transmission and inoculation of the contaminating microorganisms through gingival abrasions.[5]

Based on these reports, several simple methods have been recommended to disinfect toothbrushes, including immersion in disinfectant solutions.[17, 18] The newly developed silicone toothbrush has been design to permit the detachment of its head (fig. 1). This advantage allows the detached head to be taken for disinfection in a simple manner.

Future studies will be conducted to determine the relative abrasiveness of silicone toothbrush *in vitro* and clinical longitudinal studies.

Conclusion

In this single-use brushing study both silicone and conventional toothbrushes were similar in dental biofilm removal. However, further long-term studies are needed to support the results of this present study.

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