ORIGINAL ARTICLE

Evaluation of Plaque Removal Efficacy of Two Different Toothbrush Bristle Designs

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ABSTRACT

Introduction: Mechanical plaque control is the most effective method for preventing periodontal disease and dental caries. The various designs of toothbrushes available in the market often put the common man in dilemma about the best design, and they often seek professional advice on this matter.

Aim: The aim of the present study was to evaluate the plaque removal efficacy of two different toothbrush bristle design.

Materials and methods: The present study comprised 40 participants. Participants were randomly allotted as group I: Toothbrush with a flat bristle arrangement, and group II: Toothbrush with zigzag bristle arrangement. Baseline and after-intervention clinical examination was carried out by a single calibrated examiner to assess plaque by using Turesky–Gilmore–Glickman modification of Quigley-Hein Plaque Index.

Results: There was no statistically significant difference between groups I and II at baseline and after intervention (0.141). Furthermore, there was a statistically significant difference between the baseline and after-intervention score in both groups I (0.0001***) and II (0.004**).

Conclusion: The present study concluded that there was no superior toothbrush bristle design found. The individual skills are more concerned in plaque removal efficacy than the bristle design.

Keywords: Bristle design, Dental plaque, Plaque index, Toothbrush.

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INTRODUCTION

Plaque-induced gingivitis is the result of an interaction between plaque microorganisms and host responses. According to the literature, more than 90% of people regardless of their age or gender are affected by plaque-induced gingivitis,[1] which highlights the role of microbial plaque as the main and primary cause of periodontal diseases. Mechanical plaque control is the most effective method for preventing periodontal disease and dental caries.[2]

The bristle toothbrushes appeared about the year 1600 in China. It was patented in USA in 1857. Fredick Wilhelm Tornberg was credited for designing the first mechanical toothbrush in 1885. Toothbrushes have evolved enormously in their shape, size, and design since their launch. They have undergone a great degree of sophistication over a period of time. Various designs in head of the toothbrush like two-headed, triple-headed along with differences in bristle patterns like V-shaped, multitufted, two-level, curved, circular and diamond, trimmed, etc., have made their appearance in the history of toothbrush evolution. However, the pioneers of today's toothbrushes were developed in the 1930s.[3]

The role of toothbrushes in preventing the initiation and progression of periodontal diseases has been well documented. The various designs of toothbrushes available in the market often put the common man in dilemma about the best design, and they often seek professional advice on this matter. The bristles are perhaps the most important consideration in selecting a good toothbrush. The different bristle designs include flat trim, multilevel, wavy design, zigzag design, and many more, but no evidence of the superiority of one design over the other has been documented.[4,5] Hence, the present study was designed to evaluate the plaque removal efficacy of two different toothbrush bristle design.

MATERIALS AND METHODS

The present study comprised a total of 40 participants. Ethical approval was obtained from Al-Azhar Dental College Institutional Board and informed consent was obtained from all the participants prior to the study.

Care was taken to ensure that the students included in the study did not have any systemic disease. Subjects with decayed, extracted teeth and who have not completed permanent dentition were excluded.

Initially, all the subjects underwent a wash-out period of two-and-a-half days to rule out any possible carryover effects of the previously used oral hygiene products. The wash out was done by brushing with water alone and then followed by a treatment period of 30 days. To achieve standardized conditions, each participant was given a common dentifrice. Modified bass technique was demonstrated and instructed to follow the same for 2 minutes.

Participants were randomly allotted toothbrushes by a nonparticipating dentist:

- *Group I*: Toothbrush with a flat bristle arrangement
- *Group II*: Toothbrush with zigzag bristle arrangement

Baseline clinical examination was carried out by a single calibrated examiner to assess plaque by using Turesky–Gilmore–Glickman modification of Quigley-Hein Plaque Index.[6] Plaque was assessed on the buccal and lingual surfaces of all teeth except the third molars using the two-tone disclosing solution. Each of the toothbrushes was given a code. The codes were decoded only at the end of the study. The subjects were recalled for clinical examination after 30 days.

Statistical Analysis

Statistical Package for the Social Sciences version 17 was used to analyze the data. Descriptive analysis has been done and data were analyzed using independent t test and paired t test. The level of significance was set at 5%.

RESULTS

As shown in Table 1, out of 40 participants, 20 were males and 20 were females. Majority, 16 (40%), of the participants were in the age group of 20 years.

Table 2 shows that there was no statistically significant difference between groups I and II at baseline and after intervention (0.141). Also, there was a statistically significant difference between the baseline and after-intervention score in both groups I (0.0001***) and II (0.004**) with respect to the plaque index.

Table 1: Distribution of gender and age

	n	*%*
Gender		
Male	20	50
Female	20	50
Age (years)		
18	8	20
19	14	35
20	16	40
21	2	5

Table 2: Toothbrush group comparisons of plaque index at baseline and after intervention

		Group I (Toothbrush with a flat bristle arrangement)	*Group II* (Toothbrush with zigzag bristle arrangement)	*p-value*
Baseline	Number	20	20	0.06
	Mean	0.85	0.78	
	Standard deviation	0.16	0.08	
After intervention	Number	20	20	0.141
	Mean	0.22	0.18	
	Standard deviation	0.16	0.10	
	t-value	5.42	3.26	
	p-value	0.0001***	0.004**	

**Significant; ***Highly significant

DISCUSSION

An impressive variety of toothbrushes is available to the consumer, and the public can be confident that manufacturers strive to introduce new models that offer advantages over those that are currently available. Advances in the design of the brush handle and head, and the configuration and type of brush head bristles often seek to maximize comfort and acceptability. There is a general agreement that a positive correlation exists between bacterial plaque on the tooth surfaces and gingival inflammation. The strong association of plaque with gingivitis was revealed in several epidemiological surveys.[7] To provide home-based oral hygiene more effectively, many types of manual and powered toothbrushes have been developed. However, manual toothbrushes are still the most promising option. A good toothbrush is relatively inexpensive compared with most dental procedures. Choosing the best toothbrush begins with choosing the right bristle designs. However, selection of bristle design generally depends on individual preference. So, this study was put forth to evaluate the plaque removal efficacy of two commercially available toothbrushes with different bristle patterns.

The choice of the index was based on the fact that with this index all natural teeth (except third molars) can be assessed for plaque, and it provides more sensitive and accurate evaluation of brushing effectiveness compared with other indices used in other studies,[8] where only certain designated teeth were assessed. Moreover, the index is simple, reliable, and reproducible and facilitates comparison with other studies.[9]

The present study shows there is no significant difference between two different types of toothbrush bristles. However, this study is in contradiction to the study by Kieser and Groenveld,[10] where all brushes reduced plaque to a similar degree. The positive results in the

Kieser and Groenveld[10] study can be attributed to the use of Silness and Loe plaque index, which scores plaque on six teeth and does not take the plaque scores on the remaining teeth into consideration.

The present study shows the mean plaque score at baseline was 0.85 ± 0.16 and 0.78 ± 0.08 in groups I and II respectively. It is similar to the study conducted by Gibson et al.[11] The mean plaque scores of all the teeth except third molars for each individual for each visit were assessed. This provided more sensitive and accurate evaluation of brushing effectiveness compared with methods used in other studies like Bay et al[6] and Scopp et al[8] where only designated teeth were assessed.

However, samples and different toothbrush bristle designs used in the present study were very less. Further, long-term studies with large sample sizes are required for further assessment of the plaque removal efficacy.

CONCLUSION

The present study concluded that there was no superior toothbrush bristle design found. The individual skills are more concerned in plaque removal efficacy than the bristle design.

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