

## Research Report

### The effectiveness of sharp end and rounded end bristle toothbrush

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#### ABSTRACT

**Background:** Numerous designs of manual toothbrush are available in the market with the claims of superiority in plaque removal. It often makes the public confuse which is the best design. The sharp end bristle toothbrush is a modification that commercially available in the market. **Purpose:** The objective of the study was to compare the effectiveness in plaque removal of the sharp end bristle toothbrush and the rounded end bristle toothbrush. **Methods:** This clinical trial was a double blind crossover design. The subjects were 65 dental students, divided into two groups for comparing the 2 types of toothbrush. On the 1st day, the allocated toothbrushes were distributed to each group according to their designation, and the subjects were instructed to use the toothbrushes according their normal daily practices. On the 1<sup>st</sup>, 7<sup>th</sup>, and 14<sup>th</sup> day, the subjects were scored using the patient hygiene performance index (PHP index) and the gingival index. Based on cross over design, the same procedure was repeated during the 2 week second test periods using different type of toothbrush respectively. **Results:** The mean scores of the 2 groups showed no significant difference on the beginning the study. Though minor differences were observed in the effectiveness of toothbrush, but the comparison of the two types of toothbrush showed no statistically significant differences on 7<sup>th</sup> and 14<sup>th</sup> day. **Conclusion:** There were no significant differences between sharp end and rounded end bristle toothbrush. There is no manual toothbrush superiorly designed than the others single superior design of manual toothbrush.

**Key words:** Toothbrush, effectiveness, rounded end bristle, sharp end bristle

#### ABSTRAK

**Latar belakang:** Berbagai jenis desain sikat gigi saat ini terdapat di pasaran, dengan masing-masing menyatakan keunggulannya dalam membersihkan plak. Penelitian ini dilakukan terhadap dua jenis sikat gigi manual yaitu sikat gigi dengan ujung bulu sikat runcing dan ujung bulu sikat bulat. **Tujuan:** Penelitian ini dilakukan untuk membandingkan efektivitas membersihkan plak antara 2 jenis sikat gigi. **Metode:** Penelitian ini merupakan percobaan klinis dengan desain penyilangan (crossover) secara tertutup ganda (double blind). Subyek penelitian 65 mahasiswa dibagi 2 kelompok. Pada hari pertama, sikat gigi dibagikan pada masing-masing kelompok yang telah ditentukan jenis sikat giginya, dan diinstruksikan untuk menggunakannya sesuai kebiasaan mereka. Pada hari ke 1, 7, dan 14 dilakukan pengukuran indeks PHP dan indeks gingiva. Berdasarkan desain penyilangan, proses yang sama diulangi pada masing-masing kelompok dengan menggunakan jenis sikat gigi yang berbeda. **Hasil:** Pada awal penelitian tidak terdapat perbedaan skor pada ke 2 kelompok. Meski terdapat sedikit perbedaan, namun tidak terdapat perbedaan yang bermakna dalam efektivitas kedua jenis sikat gigi setelah penggunaan selama 7 dan 14 hari. **Kesimpulan:** Tidak ada perbedaan yang bermakna antara sikat gigi jenis ujung bulu sikat bulat dan ujung bulu sikat runcing. Tidak terdapat satupun jenis sikat gigi yang paling baik.

**Kata kunci:** Sikat gigi, efektivitas, ujung bulu sikat bulat, ujung bulu sikat runcing

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## INTRODUCTION

Dental caries and periodontal diseases are major problems in dental health. Dental plaque is the risk factor of dental caries and periodontal diseases.<sup>1</sup> Tooth brushing is the regular removal of dental plaque on the teeth and adjacent gingival surface. Tooth brushing is the most effective method to maintain healthy conditions for teeth and gingival.<sup>2</sup> Several types of toothbrush are available in the market with the claims of superiority for a particular design. Generally, toothbrushes vary in size and design, diameter, length, hardness, arrangement and material of the bristles as well. The claims of superiority are primary based on plaque removing efficacy and ease of use. However, there is still a lack of data on their efficacy in plaque removal and gingivitis reduction.<sup>1,3,4</sup>

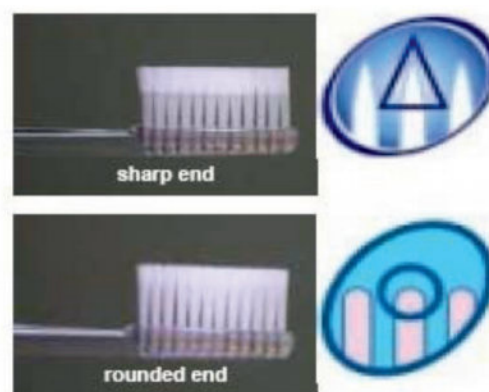
The various designs of toothbrushes available in the market often confusing the public which is the best design and they often seek professional advice on this matter. The type of the bristles is important consideration in selecting a good toothbrush. Because of the varieties of brushes currently available, the dental professional must maintain a high level of knowledge of these products. Ideally, clinical study should be carried out to compare the existing models and new designs as they appear on the market. The design of manual toothbrushes has been modified and refined in pursuit of more effective plaque removal and improved oral health.<sup>3,5,6</sup>

In recommending a particular toothbrush, the effectiveness in plaque removal and the safety from injury, as well as the perception that the brush works well are important considerations.<sup>1</sup> The American Dental Association (ADA) recommended that the toothbrush should be able to clean teeth effectively and thoroughly, the bristles are free of sharp or jagged edges and endpoints; the bristles would not fall out with normal use, the toothbrush can be used to provide a significant decrease in mild periodontal disease and plaque, also the handle material has the durability under normal use.<sup>7,8</sup>

Choosing the right bristles is very important in choosing the toothbrush. Bristles are important because they directly contact the teeth and gum tissue. The effectiveness of toothbrush bristle is based on shape, type, and arrangement. Hard, medium, and soft-bristled toothbrushes all remove plaque; however, hard bristles may cause irreversible damage to the gum, tongue, and cheeks, also can lead to periodontal disease and receding gum lines. Studies showed that soft-bristled toothbrushes remove plaque as effectively as medium or hard bristles.<sup>3,8</sup>

The sharp end bristle toothbrush is a modification that commercially available in the market. The modification is on the bristle of the toothbrush that had a smaller diameter at the top of the bristle (Figure 1). Even though the bristle has a sharpen shape, but the tip of the bristle is trimmed perfectly round to prevent gum injury. It is assumed that the sharp end bristle has a better cleaning efficacy, because the brushing action can be made more effective. On the marketing process, the manufacturer claimed the effectiveness of the

sharp end bristle toothbrush in plaque removal, although there was a lack of its evidence basis.



**Figure 1.** Sharp end bristle toothbrush and rounded end toothbrush.

The aim of the study was to compare the sharp end bristle toothbrush with the conventional round end bristle toothbrush on the effectiveness of plaque removal and maintaining gingival health. The identification of the effectiveness of the toothbrushes would guide the dental professionals in recommending the toothbrush of choice for the public.

## MATERIALS AND METHODS

The study was a double blind clinical trial, and the cross over design<sup>9</sup> was conducted to compare the 2 types of toothbrush commercially available in the market comprise of sharp end bristle toothbrush and rounded end bristle toothbrush. The study was carried out at the Dental Hospital of Prof Dr Moestopo University, Jakarta.

The subjects of the study were dental students that at random divided into 2 groups. The criteria for the subjects were good general health, at least 28 functionally good teeth (excluding third molar), good soft oral tissue, no calculus or periodontal diseases, good occlusion, no smoking, no extensive restorations, not using orthodontic appliances, and using no other oral hygiene procedures (mouthwash, tooth whitening, etc).

The study used 2 types of toothbrush comprise of sharp end bristle toothbrush and rounded end bristle toothbrush. The two types of toothbrush were similar in all specification, and the difference was only in the bristles (Figure 1).

The study was conducted over 4 weeks and involved six visits. At the initial day the toothbrushes were distributed to each group according to the designation of the study. The subjects were instructed to use the toothbrush for 2 weeks, according to their daily tooth brushing method, with the same tooth paste. Cross overly the same procedure was repeated during the second week second test periods using different type of toothbrush respectively.

The plaque reduction were evaluated using patient hygiene performance index (PHP index) and the gingival

condition were evaluated using gingival index.<sup>1</sup> The assessment were conducted at the 1<sup>st</sup> day (initial day), and after the 7<sup>th</sup> and 14<sup>th</sup> day using each type of toothbrush respectively. A set of questionnaires were used to access the perception of the subject on the use of the toothbrushes. Statistical analysis of the data was carried out using t test, and chi square test. The computer analysis of the data used the statistical package for social sciences (SPSS) software version 17. The values of  $p < 0.05$  were considered statistically significant.

## RESULTS

A total of 65 dental students consist of 54 females and 11 males participated. The ages the subjects mostly were 18 years old, the range was 17 until 19 years old, and the mean age was 17.77 years old. The assessment using the PHP index and gingival index were carried out at the 1<sup>st</sup>, 7<sup>th</sup> and 14<sup>th</sup> day after using each type of toothbrush. No changes in hard or soft oral tissues were reported post-brushing and no adverse events occurred. The scores of PHP index and gingival index were displayed on Table 1 and 2.

At the initial day before using sharp end bristle toothbrushes, the mean scores of the PHP index and the gingival index of the subjects were 2.005 and 0.140. After using the sharp end bristle toothbrushes at the 7<sup>th</sup> and the 14<sup>th</sup> day, the PHP index mean scores decreased into 1.818 and 1.690, and the gingival index mean scores decreased into 0.094 and 0.070 respectively.

At the initial day before using rounded end bristle toothbrushes, the mean scores of PHP index and gingival index of the subjects were 2.136 and 0.165. After using

**Table 1.** The PHP index at the 1<sup>st</sup>, 7<sup>th</sup> and 14<sup>th</sup> day

Day	PHP index				p score
	Sharp end bristle		Rounded end bristle		
	Mean	Standard Deviation	Mean	Standard Deviation	
1	2.005	1.032	2.136	0.937	0.720
7	1.818	0.818	1.463	0.741	0.009
14	1.690	0.772	1.724	0.690	0.987

**Table 2.** The gingival index at the 1<sup>st</sup>, 7<sup>th</sup> and 14<sup>th</sup> day

Day	Gingival index				p score
	Sharp end Bristle		Rounded end bristle		
	Mean	Standard Deviation	Mean	Standard Deviation	
1	0.140	0.138	0.165	0.165	0.863
7	0.094	0.092	0.092	0.074	0.839
14	0.070	0.084	0.061	0.070	0.401

**Table 3.** The perceptions on the cleaning efficacy of the toothbrushes

Cleaning efficacy	The bristles of the toothbrush	
	Sharp	Rounded
Very Good	8 (12.3%)	6 (9.4%)
Good	50 (76.9%)	56 (87.5%)
Neutral	3 (4.6%)	0 (0%)
Bad	4 (6.2%)	2 (3.1%)
Very bad	0 (0%)	0 (0%)
$\Sigma$	65 (100%)	64 (100%)

**Table 4.** The perception on the comparison of using the toothbrushes

Perception	Subject (n)	%
The sharp end was much better	3	4.6
The sharp end was better	25	38.5
No difference	12	18.5
The round end was better	21	32.3
The round end was much better	4	6.2
$\Sigma$	65	100

the rounded end bristled toothbrushes at the 7<sup>th</sup> and the 14<sup>th</sup> day, the PHP index mean scores decreased into 1.463 and 1.724, and the gingival index mean scores decreased into 0.092 and 0.061 respectively.

The comparisons between 2 types of toothbrush were statistically analyzed using paired t test. At the beginning of the study, between the 2 groups showed no significant difference of the mean scores of the PHP index ( $p=0.720$ ) and also the Gingival Index ( $p=0.863$ ). At the 7<sup>th</sup> day there was significant difference on the mean scores of PHP index between the 2 types of toothbrush ( $p=0.009$ ), but at the 14<sup>th</sup> day showed no significant difference. The mean scores of gingival index showed no significant difference between the 2 type of toothbrush at the 7<sup>th</sup> day ( $p=0.839$ ), and at the 14<sup>th</sup> day ( $p=0.401$ ).

The questionnaire was on the perceptions of the subjects on using the toothbrush that comprising of the perception on cleaning efficacy, the comfort in using the toothbrush, also on the hardness and the sharpness of the bristles. The data of the perceptions on using the 2 types of toothbrush were on Table 3 and 4. Based on the perceptions of the subjects, most of them stated that both toothbrushes were good in cleaning efficacy to their teeth, and statistical analysis using Paired t test showed no significant difference between the 2 types of toothbrush ( $p=0.27$ ). In comparing the 2 types of toothbrush, 25 subjects (38.5%) perceived the sharp end bristle toothbrush was better than the round end bristle toothbrush, but 21 subjects (32.3%) perceived the round end bristle toothbrush was better than the sharp end bristle toothbrush, while 12 subjects (18.5%) perceived there was

no difference between the 2 types of toothbrush. Chi-square test showed no significant difference on the comparison of both types of toothbrush ( $p=0.101$ ).

## DISCUSSION

Many researches have been conducted evaluating the effectiveness of many different types of toothbrush. Tooth brushing is one of the most studied topic areas in the field of dentistry, with many publications on efficacy, methods of brushing, and types of brushes, documenting the health benefits of mechanical removal.<sup>6</sup> This study compared the effectiveness of the sharp end bristle toothbrush with the rounded end toothbrush. The dental students as the subjects of the study were relatively homogenous in the sense of their age and oral hygiene awareness. As dental students, they had good oral hygiene shown in their scores of PHP index and gingival index. According to Wolf *et al.*<sup>9</sup> the cleaning efficacy of different toothbrushes was frequently tested in a cross over design on the same subjects to control the testing effects. That the subjects keep up in creased oral health awarness during the course of the study founded on the improved oral hygiene.

The effectiveness of tooth brushing was showed in the difference of the scores of PHP index and gingival index between baselines and after using the toothbrushes at the 7<sup>th</sup> and 14<sup>th</sup> day. The comparison of the effectiveness of the 2 types of toothbrush showed no significant difference. Moreover the subjects perceived that there was no significant difference between the 2 types of toothbrush in cleaning efficacy. Opinion regarding the benefit of the toothbrushes on this study was comparable in the same subjects, and they perceived a benefit from both types of toothbrush. Based on the results of this study, the 2 types of toothbrush were similar in their effectiveness. Significant effectiveness in plaque removal could be achieved regardless of the toothbrush bristles used.

The present clinical study was undertaken to find out the claim of the effectiveness of sharp end bristle toothbrush. The results of the study indicated that the sharp end bristle toothbrush significantly reduced the plaque, but yet no significant differences were observed when compared with the conventional rounded end bristle toothbrush. The results were in line with the study of Sripriya and Ali<sup>5</sup> that showed no significant differences in plaque removal between four different bristle designs of toothbrushes.

Comparative clinical studies are crucial for assessing the relative effectiveness of different toothbrushes. There were few published studies that have investigated the plaque removal effectiveness of various types of toothbrushes, and some of the results had not demonstrated definitively that any one design was absolutely better.<sup>11,12</sup> The results are conflicting, with some studies reporting some designs of

toothbrushes to be superior, but the general consensus in most of the studies has been that there is no one superior design of toothbrush for plaque removal.<sup>4,5,8,10,13</sup>

No significant difference between the 2 types of toothbrush bristles in this study was largely due to the complexity of tooth brushing. Thus making a specific toothbrush recommendation on the basis of sound science is not easy. Toothbrush bristles was only one of several factors that contribute to the effectiveness of tooth brushing. The effectiveness of tooth brushing depended not only on the design and the bristles of the toothbrush, but also depended on various other variables such as knowledge, skill, manual ability, the amount of forces used to brush, attitude, time devoted for tooth brushing, dental arch anatomy, and tooth brushing method.<sup>1,6,8</sup>

As the conclusions, the sharp end bristle toothbrush and the round end toothbrush, both were significantly effective to reduce plaque and maintain gingival health, but there were no significant differences between those two types of toothbrush. Further study on different types of toothbrush is needed in order to invent new innovations for a better toothbrush design.

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