

Clinical efficacy of two manual toothbrushes on plaque and bleeding indices

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Original Article

Abstract

BACKGROUND AND AIM: The mechanical removal of plaque by tooth brushing is the most effective way for prevention of caries and periodontal diseases. Some studies indicate that the design and shape of toothbrush could be the effective for this point. The aim of this study was to compare the efficacy of a Classic toothbrush with a Superbrush toothbrush in controlling plaque and gingival bleeding over a 2-week period of brushing.

METHODS: This study was a crossover clinical trial, involving 30 healthy individuals who were dental students of both sexes, randomly divided equally into two groups with simple method: group A (Classic Toothbrush; Soft, Tepe, Sweden) and group B (Superbrush Toothbrush; Soft, Dentaco AS, Haukeland, Norway). After taking an informed consent, the baseline O'Leary plaque index (PI) and bleeding point index (BPI) was recorded, and the subjects were given common toothpaste (Crest). A prophylaxis was performed to achieve the PI of zero and then the demonstration of Bass technique was given to each subject. Each group started the experiment with a different type of toothbrush for 1 week which followed by 1 week of wash-out. After that, each group switched to the next type of toothbrush for 1 week. All subjects had to refrain from other oral hygiene procedures for the duration of the study. The results were analyzed statistically by independent t-test and paired t-test. A statistical significance was set at the 95% confidence level ($P < 0.050$).

RESULTS: Superbrush showed a significant reduction of both PI ($P = 0.050$, $P < 0.050$) and BPI ($P = 0.001$) at 7 and 14th days with respect to the baseline. The analysis revealed that the Superbrush was significantly a more effective in removing plaque as compared to the Classic toothbrush ($P < 0.010$), while according to the BPI, there were no statistically significant differences between the two brushes ($P = 0.185$, $P > 0.050$).

CONCLUSION: The results showed the efficacy of Superbrush toothbrush in a significant reduction of PI and BPI, so it can be suggested to patients as an alternative to the Classic toothbrush.

KEYWORDS: Dental Plaque Index; Bleeding Point Index; Tooth Brushing

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It has been known for many years that dental caries and plaque-induced periodontal diseases are the two most common oral diseases caused by microorganisms, which colonize the tooth surface and dental plaque deposits on the tooth surface.^{1,2} Dental plaque is an essential etiological factor of caries and gingivitis.^{2,3} Microbial plaque growth occurs within hours, and it must be completely removed at least once every 48 hours in the

experimental study with periodontally healthy subjects to prevent inflammation.^{4,5}

The normal tooth brushing practices adequately performed by anyone could be sufficient to control bacterial plaque. However, several tooth brushing methods have been proposed which the most used are: Bass, Modified Stillman, Stillman, Scrub, Roll, Charter and etcetera., the Bass technique and the roll method being two of the most common recommended techniques in dental

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practices. The Bass technique is claimed to be the method of choice for cleaning lingual surfaces of mandibular molars and premolars⁶ and is superior to the Roll method in cleaning the tooth tissue adjacent to the gingival tissue, the gingival margins, and the sulcus.⁷

A study evaluated the role of brushing technique and toothbrush design in plaque removal and concluded that the plaque removing ability was greater when the Bass technique was used together with the V-shaped toothbrush on linguo-distal and linguo-mesial surfaces, especially when interproximal areas did not show any periodontal tissue breakdown.⁸

Toothbrush manufacturers have made great effort in considering many different aspects when designing new models to meet the challenge of enhancing plaque biofilm removal through improved tooth brushing efficacy.⁹ These and similar breakthroughs have led to the emergence of numerous types of specially-designed manual toothbrushes to improve dental health. This motivated the researchers to make a comparison between different brands and types of toothbrushes and to identify and recommend the best designs.^{8,10-14} Narang et al.³ in a study consisted of 100 non-clinical dental students compared the plaque removing efficiency of two branded toothbrushes with different brush head design and bristle arrangement in routine oral hygiene practice. They concluded that the arrangement of bristles plays a convincing role in reduction of plaque besides the manual dexterity of an individual.

One of the new developments is a manual triple-headed brush (so-called Superbrush) which is intended to clean the lingual, buccal and occlusal surfaces of the teeth at one time. Levin et al.¹³ evaluated the effect of toothbrush design on brushing skills and plaque removal among young healthy adults and they found that the triple-headed toothbrush promote easier tooth brushing and plaque removal both before and after

receiving tooth brushing instructions. Oliveira et al.¹⁵ in a study on 20 children aged 4 years old, with sound and complete primary dentition, showed that effective biofilm removal was achieved with both Classic and triple-headed toothbrushes; however, the triple-headed type had a better performance on surfaces when the mother brushed the teeth of the child. Thus, the present clinical study sought to evaluate the effectiveness of plaque removal and gingival bleeding point index (BPI) by using the triple-headed toothbrush compared to a Classic manual toothbrush.

Methods

This study was a crossover, single-blind clinical trial, involving 30 healthy individuals who were dental students of both sexes (half of them were female and half were male). This study was conducted in the Department of Periodontology of Kerman Dental College in Iran and was approved by the Ethics Committee of Kerman University of Medical Sciences (No. K/92/178). The trial was registered in Iranian Registry of Clinical Trials (IRCT), No.IRCT2015051517619N3. Convenience sampling was performed for enrolling the subjects in the study. Assigning the subjects to the Classic (Soft, Tepe, Sweden) and Superbrush (Soft, Dentaco AS, Haukeland, Norway) brushing (Figure 1) groups was done randomly with simple method. In simple random sampling, the most primitive and mechanical method would be the lottery method. Each member of the population is assigned a unique number. Each number is placed in a bowl and mixed thoroughly. The blind-folded researcher then picks half of the numbered tags from the bowl. All the individuals bearing the numbers picked by the researcher will be assigned to the first group.

An informed consent was obtained from the participants. A screening questionnaire was assigned to all subjects who participated to the study for recording the plaque and

bleeding point indices. All subjects received a baseline plaque assessment, and they were given common toothpaste (Crest). The inclusion criteria were as follows:

All the selected subjects met with the following criteria: minimum of 20 natural teeth, the absence of underlying systemic disease with a detrimental effect on the periodontal condition, lack of caries. The exclusion criteria were as follow: pregnancy, history of drug/alcohol abuse, smoking or chewing tobacco, use of any medication and presence of: orthodontic appliances or implants, crowding of the teeth, restorations with overhangs, extensive restorations; partial prosthetic rehabilitation or/and bridges, deep pockets, severe periodontal disease and mouth-breathing.^{14,16}



Figure 1. From left to right: Classic toothbrush and Superbrush

The amount of plaque was recorded using the O'Leary plaque index (PI)⁷ and then a prophylaxis was performed to achieve the PI of zero.^{14,16} All the subjects were demonstrated Bass method of brushing at each visit with its assigned toothbrushes:

Superbrush or Classic toothbrush. All subjects were requested not to do any oral hygiene procedures for 48 hours prior to the baseline records.^{17,18} After that, their plaque and bleeding point indices were assessed and recorded (Figure 2).

Subjects were given their first randomly assigned toothbrush to use twice each day and to put aside all other oral hygiene products (i.e., inter-dental cleaning products, mouth rinses and etcetera) for the duration of the study. Subjects used brushes for 1 week, and they were reminded to abstain from all oral hygiene for 24 hours prior to their visit and to bring their toothbrush with them. The procedure was the same at the next visit. After 1 week of application, the O'Leary PI and the BPI were used to assess the effectiveness of the two brushes on the mentioned parameters. This was followed by 1 week of wash-out.^{16,19} Afterward subjects were given the next toothbrush and instructed again. The total duration of the study was 3 weeks. The PI and BPI were recorded at the end of each brushing session. The results were analyzed statistically by independent t-test between groups and by paired t-test within groups.

Results

This study was designed to compare the ability of both Classic and Superbrush toothbrush on plaque and gingival bleeding point indices reduction. All the subjects

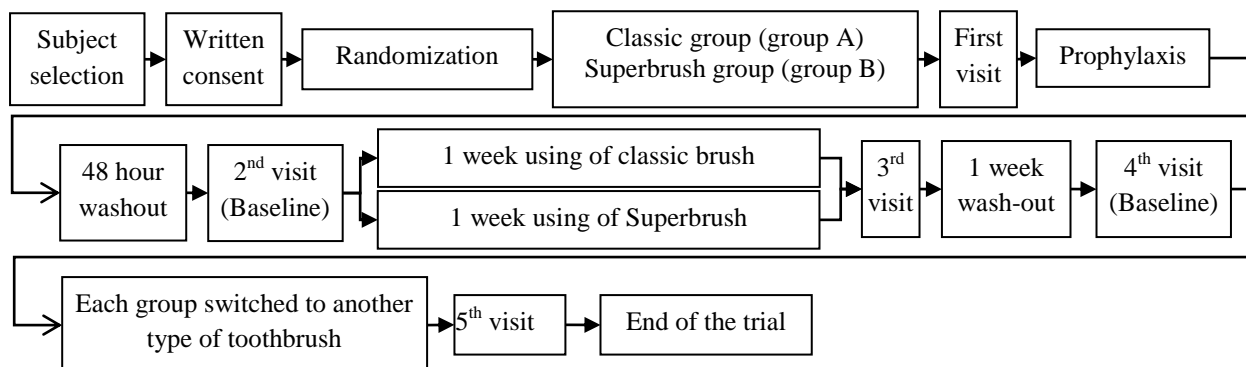


Figure 2. Flowchart of the study

successfully completed the study period of 2-week, none dropped out, and all the subjects maintained their recall appointments. Bleeding point and plaque indices of all participants both before and after a period of 1-week of brushing with each brush were measured. Therefore, during the study, the indices of every subject were measured 4 times and registered in their individual form.

The mean O'Leary PI at the first visit was 46.28 ± 6.51 (range from 36.61 to 59.82; median: 45.54) that by prophylaxis were set to zero. The following 48 hours of no oral hygiene and second visit (baseline) it reached on average 31.07 ± 3.90 and 30.12 ± 3.87 , which was reduced to 19.28 ± 2.59 and 16.48 ± 2.61 for the Classic and Superbrush group, respectively, at the end of the study. Mean BPI were 8.14 ± 1.24 and 7.84 ± 1.84 for both groups which decreased to 7.46 ± 1.22 and 6.79 ± 1.73 respectively at the end of the study.

Mean percentage changes of variables for both Classic and Superbrush groups in case of PI were 37.65 ± 7.15 and 46.51 ± 8.84 and in the case of BPI were 1.79 ± 0.84 and 1.28 ± 0.48 , respectively. The amount of reduction in the PI for both toothbrushes was statistically significant at 7 and 14th days with respect to baseline (Table 1). Moreover, in terms of the PI, the Superbrush toothbrush was significantly more effective compared to the Classic toothbrush (Table 1) while according to the BPI there were no statistically significant differences between the two brushes. No significant differences in the BPI in Classic toothbrush

($P = 0.052$) was observed. The analysis revealed that PI for the Superbrush were significantly lower as compared to the Classic toothbrush ($P = 0.050$, $P < 0.050$) while, it was not significant for the BPI ($P = 0.185$, $P > 0.050$).

Discussion

The study showed that within the limitations of the 2-days non-brushing design, a significant difference was found both within and between the groups by considering PI, but in the case of BPI, the significant difference was related to Superbrush group ($P = 0.001$). Both brushes significantly reduced the plaque accumulation, though to different degrees. Moreover, from the different studies it can be concluded that different types of brushes significantly reduces the PI albeit the differences between the groups will not be significant if it is done by skilled subjects or over a longer period of time.

Zimmer et al.²⁰ In a single-blind crossover study found that a Superbrush toothbrush was significantly better at removing plaque than a Classic brush, the results of the present study demonstrated better cleaning effects by the Superbrush as compared to a Classic toothbrush which is in accordance with the findings of the study of Zimmer et al.²⁰ As compared to a Classic toothbrush, the Superbrush was of similar effectiveness in BPI ($P = 0.185$). In the current study, there was relatively large plaque accumulation after the first 24 hours wash-out, which reduced significantly in both groups.

Table 1. Paired t-test and independent t-test for each variable

Variable	Differences (mean \pm SD)	95% CID		P
		Lower	Upper	
PI				
Classic	11.78 ± 3.02	10.65	12.91	< 0.001
Superbrush	14.58 ± 3.79	13.16	15.99	< 0.001
BPI				
Classic	0.67 ± 1.82	-0.01	1.57	0.052
Superbrush	1.05 ± 1.61	0.529	1.91	0.001
PI				
Classic versus Superbrush	8.86 ± 7.08	4.706	13.02	< 0.001
BPI				
Classic versus Superbrush	5.30 ± 4.19	-2.59	15.45	0.185

PI: Plaque index; BPI: Bleeding point index; CID: Confidence interval distributions; SD: Standard deviation

Parizi et al.²¹ found that PI decreased significantly in all groups, except Oral-B. They reported a significant 53% reduction in the PI in the Panbehriz Classic group (from 20.92 to 9.91, $P = 0.007$). Oliveira et al.¹⁵ in their study showed that statistically significant difference was observed on biofilm removal on occlusal and smooth surfaces, regardless of the toothbrush used or who performed the brushing ($P < 0.001$). Levin et al.¹³ have showed that the triple-headed toothbrush will promote easier tooth brushing and plaque removal both before and after receiving tooth brushing instructions. The aforementioned results were in agreement with the prevailing literature on this respect^{16,18} as all toothbrushes significantly decreased the PI, which is identical with our results. Finally, our results showed that both designs are safe enough to decrease PI and BPI.

Conclusion

On basis of the results of this study, both

Classic and Superbrush toothbrushes had well performance during the 2 weeks of twice daily use in reduction of PI and BPI. However, the Superbrush was significantly more effective than the Classic toothbrush in a reducing dental plaque after 2 weeks of product use so the handling of the Superbrush seems to be easy. Furthermore, it seemed that the bristle design affects the plaque removal efficacy of the toothbrush and decreasing the BPI besides the manual dexterity of an individual. Accordingly, the use of Superbrush could be suggested for patients.

Conflict of Interests

Authors have no conflict of interest.

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