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The Bass technique using a specially designed toothbrush

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Abstract: *Background:* Reducing the plaque index (PI) is still the main objective in the prevention of gingivitis and periodontitis. *Aim:* This experiment evaluated the efficiency of a new manual toothbrush shape from two perspectives: allowing the maximum exploitation of the bristle surface in all directions of the dental arches and simplifying the Bass technique handling and movements in domestic oral care. *Patients and method:* The distinct shape was obtained by distancing the bristle surface from the surface of the toothbrush handle in the direction of the bristles, maintaining the two surfaces on parallel planes. This modification facilitates brushing with the Bass technique, since rotation of the new toothbrush handle on its axis allows the bristle surface to cover a greater area. Sixteen patients between the ages of 23 and 49 years with at least 28 dental elements were divided randomly into two groups. On the first day, they underwent professional plaque removal and were provided with pairs of toothbrushes to test. They were evaluated 30 days later using the Full Mouth Plaque Score determined by two dental hygienists who were unaware of the instructions given concerning the method, quadrants and toothbrushes used for the experiment. *Results:* The results showed that the modifications to the manual toothbrushes produced greater PI control compared with the traditionally shaped toothbrushes. *Conclusion:* Although oral hygiene testing at home usually provides subjective information, in this experiment, the data provided a positive, objective result.

Key words: Bass technique; dental hygienist; gingivitis; manual toothbrush; oral hygiene; plaque index

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Introduction

The main objective of oral hygiene at home is to reduce plaque levels and avoid the damage that plaque causes to dental and

periodontal tissues (1, 2). Deficiencies in personal oral hygiene are largely influenced by lack of compliance and individual dexterity (3). Moreover, a considerable number of individuals remove only 50% of the bacterial plaque even after brushing for the recommended 2 min (4). The presence of bacterial plaque causes gingivitis and periodontitis (5), against which specific mechanical removal of plaque, both professional and at home, is still the most effective defence (2, 6).

This is why dental hygienists devote time to patient motivation concerning oral hygiene at home, teaching, among other things, the Bass technique (7). The same cleaning instructions should be given when the patient has fixed dental restorations, such as veneers, fillings, crowns, partial crowns, a bridge, or implants, because several studies have indicated that the plaque that forms on hard artificial surfaces does not differ significantly in structure or microbiology (8–12), and that its development is similar on natural or artificial materials (13).

An analysis of data from 7 years of dental hygienist practice (507 clinical records) indicated that during home brushing – performed either correctly or incorrectly – some surfaces of the dental arches were reached only by a limited number of patients. Furthermore, these particular patients were exceptionally careful, capable of manually performing proper hygiene using a toothbrush and usually free of any periodontal, orthodontic or manual problems.

The areas of insufficient hygiene were noted on the clinical record of each patient at every recall appointment. The clinical records showed that the sites that individuals omitted to brush most frequently were the molar areas, particularly the palatal and lingual sides of the teeth.

If one analyses the most common shapes of manual toothbrushes (Fig. 1) – with the handle, neck and head on the same work level – one can see how the bristle surface is generally less than 1 cm from the surface that lies on the side of the handle facing the bristles. Toothbrushes designed this way provide patients with limited access inside the mouth because of the incisor teeth, which force the patient to hold the brush so that the angle between the bristle surface and the surfaces of the teeth and gums is too wide. In other words, not all areas of the mouth are easily reachable; in those areas, the bristle surface loses part of its hygiene potential, as it cannot fully contact the teeth and gums because the handle strikes an obstacle (Figs 2 and 3). To prevent damage to the teeth and gums in these more hidden areas, the build-up of bacterial plaque (2, 5) must be reduced, thus lowering the plaque index (PI) (14).

Moreover, this commonly used design limits the radius of action of the bristle surface when applying the Bass technique. To obtain a satisfactory radius of the bristle surface, these toothbrushes require wide rotations on the axis of the handle (and of the patient's wrist), which makes handling and movement difficult (Fig. 1).

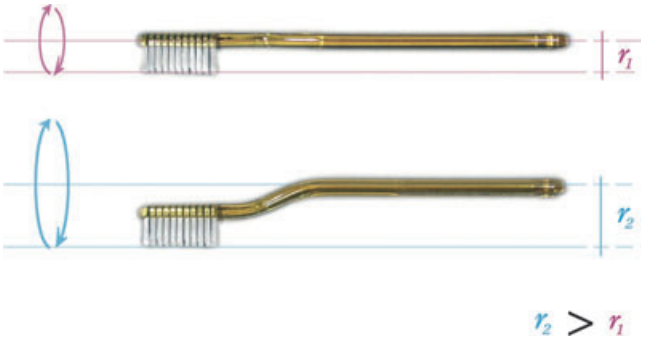

Fig. 1. Comparison between a traditional manual toothbrush and a toothbrush with the new shape. Using the same wrist rotation, the new shape results in greater rotation of the bristles.

Fig. 2. Levels considered in the experiment.

After observing this phenomenon, I devised an experiment to evaluate the efficiency of a new manual toothbrush shape from two perspectives: allowing maximum exploitation of the bristle surface in all directions of the dental arches and simplifying Bass technique handling and movements in domestic oral care.

Patients and methods

Study population and methodology

Sixteen right-handed patients (expected difference between groups 10%, $\beta = 85\%$)* between the ages of 23 and 49 years (mean age 31.6; median 28.5; SD 7.3), in good health, with no periodontal disease, manipulation problems, or orthodontic

*WHO: average prevalence of dental plaque 85%, sample size and power calculation by "PS Power and Sample Size Calculations"

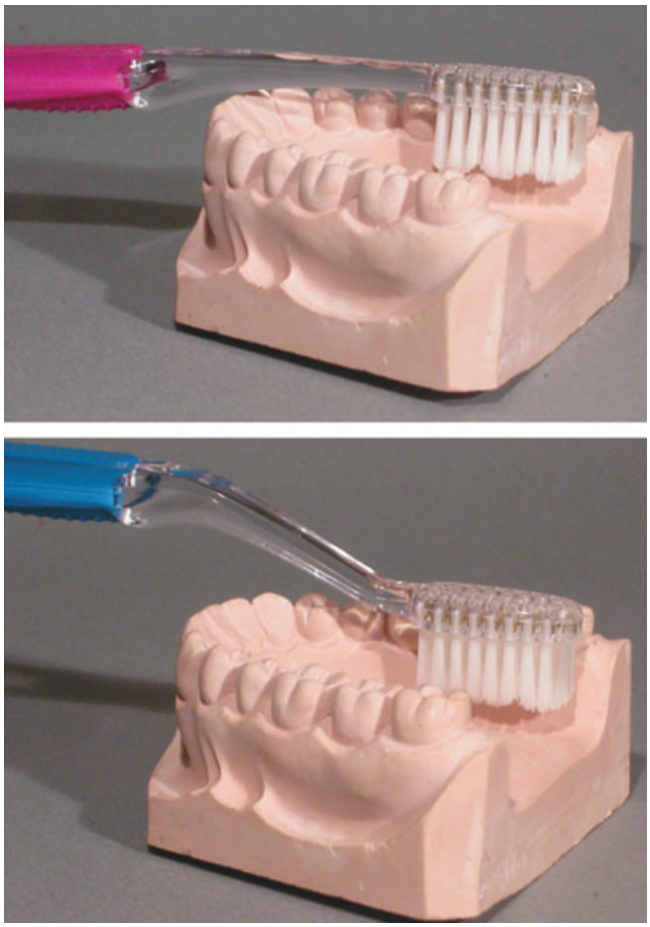

Fig. 3. Using the modified toothbrush, the incisor edges of the four central teeth are no longer an obstacle to the handle.

devices, and with at least 28 dental elements present were selected. To perform the experiment in a double-blind manner, the patients were divided into two groups randomly (A, B) and were evaluated by two dental hygienists who were unaware of the instructions given concerning the method, quadrants, and toothbrushes used for the experiment.

Informed consent was obtained from the participants before commencing the clinical examination, which was carried out in private practice. To reflect day-to-day standard oral hygiene, no explanation of the objectives and nature of the research was given (15). At the first appointment, a hygiene treatment was used to obtain a PI equal to zero. At the same appointment, each patient was instructed to use the Bass technique at home for 3 min, once a day without using interproximal cleaning instruments.

Eight different manual toothbrushes of four well-known brands readily found in shops were used. Each patient received two samples of the same toothbrush (same manufacturer and model), one of which was specially modified, as

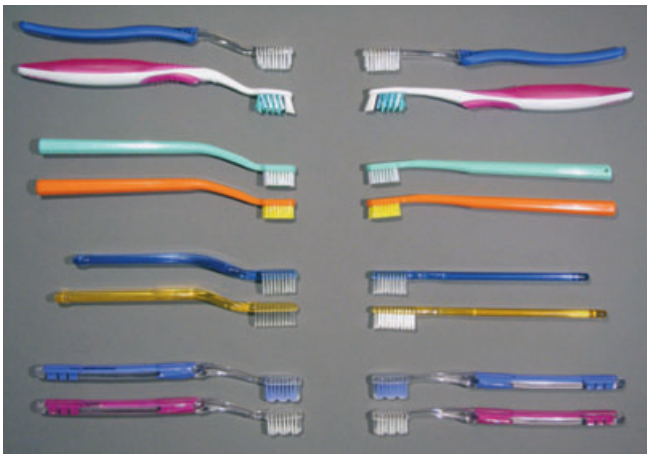

Fig. 4. The toothbrushes used in the experiment.

shown in Fig. 4. The shape was obtained by distancing the bristle surface from the toothbrush handle in the direction of the bristles, maintaining the bristle surface and the handle on parallel planes.

The mean deviation between the bristle surface and the surface of the handle in the modified prototypes, in the direction of the bristles, was increased from 1.0 ± 2 μm in the control samples to 2.3 ± 2 μm in the test samples.

The eight patients in group A were instructed to clean the first and fourth quadrants using the modified toothbrush only (test), brushing for 1.5 min, and to use the other unmodified toothbrush only in the second and third quadrants for the remaining 1.5 min. The same instructions were given to the eight patients in group B, simply inverting the hemiarches, testing the modified brushes in the second and third quadrants.

A special clinical record was created for each group, which noted the PI values for the four dental surfaces (mesial, lingual, distal, vestibular) of each element present in the arch, using the Full Mouth Plaque Score.

To reduce risks to healthy tissues, each group member was examined once every 7 days during the observation period. At the end of the period, that is, after the 30th day of observation, the patients underwent a professional dental hygiene treatment. The observation period was chosen according to the availability of patients and staff, in compliance with Loe *et al.* as regards gingival inflammation (5). That study maintained that in most individuals, plaque grows for 10–21 days until clinically visible gingivitis develops, and even at this stage, the clinical signs are reversible following the removal of microbial plaque using effective plaque control measures.

The values were analysed statistically using Student's *t*-test ($P < 0.05$, Fisher's exact test).

Table 1. **Group A**

Test Quadrants I and IV (%)	Control Quadrants II and III (%)
14.58	44.79
28.89	56.67
7.69	19.05
15.63	39.58
13.54	20.83
61.11	76.04
40.20	77.78
30.21	46.88

Table 2. **Group B**

Test Quadrants II and III (%)	Control Quadrants I and IV (%)
5.21	16.67
10.71	24.36
9.37	15.63
0.00	14.58
9.52	25.00
55.21	42.71
4.76	23.81
10.71	19.05

Results

Tables 1 and 2 summarize the improvement in oral hygiene performed at home for 15 of the 16 patients, with the average diminution in the PI (Student's *t*-test; $P < 0.05$, PI = 2.2).

Discussion

Epidemiologic studies conducted in the 1960s reported a strong correlation between plaque and gingivitis (16), with further research showing a high prevalence of gingival disease in the population beginning at a young age (17, 18). The prevalence of gingivitis – still observed today – confirms that manual cleaning is insufficient to maintain gingival health in many people. One of the possible causes of this widespread prevalence of periodontal disease was suggested in the late 1970s, when it was observed that at best, individuals spent less than 10% of the entire brushing cycle cleaning the lingual and palatal surfaces, and some spent no time at all on these sites (19, 20).

Moreover, if one observes the mandibular anatomy (Fig. 2), one can see how the incisor edge of the four central teeth becomes an obstacle to reaching the edges of the gums of the molars by blocking the head of the toothbrush. The incisors force the handles of traditional manual toothbrushes to such an angle as to prevent complete contact of the bristles with all areas of the dental arches. This shortcoming is particularly evident in the lingual and palatal areas, which consequently reduces the hygiene potential developed by the head of the brush on the more accessible vestibular sides. In comparison, photographs of plaster cast models (Fig. 3) show how the head of the prototype reaches all areas of the mouth with a substantial increase in bristle activity.

A further advantage, easier movements of the wrist while performing the Bass technique, arises because the greater the distance is between the bristle surface and the surface of the handle (in the direction of the bristles), the smaller the amount of handle rotation needed to achieve a satisfactory radius of action for the bristle surface (Fig. 1). This facilitates movement for oral hygiene in general, with obvious benefits for those affected by periodontal, orthodontic, or manual problems.

The toothbrush is still the most frequently used tool for mechanical plaque removal at home, and the resulting quality and quantity of oral hygiene are controlled by three main factors: toothbrush shape, individual ability to use the toothbrush, and the frequency and length of toothbrush use (3).

In the light of these findings and considering the brushing techniques suggested by professionals, the aim of this experiment was to test whether it was possible to improve toothbrush hygiene potential simply by modifying the generic shape and enhancing brushing efficiency, and whether the new shape would contribute to better individual oral hygiene practices. The experiment was based on one concept: shifting the bristle surface farther from the surface of the toothbrush handle facing the bristles, while maintaining the two surfaces on parallel planes.

The results demonstrate that the modifications made to the manual toothbrushes produced greater control over bacterial plaque build-up, compared to traditionally shaped toothbrushes, reducing the PI. Moreover, the lower level of bacteria in patients using the prototype toothbrush confirms that this modification to a toothbrush represents a valid method of minimizing damage to dental and gum tissue while performing the Bass technique.

These results are especially valuable in light of studies and observations made in the early 1980s, which indicated how maintaining a good degree of personal oral hygiene is the best assurance of periodontal health and that its influence on periodontal stability is greater than that of periodic check-ups and professional hygiene sessions (21).

This is the first study of the prototype toothbrush. Further research, with a larger test panel and a negative control group, is needed to confirm the results over time.

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