Comparison of the Efficacy of Oral B Cross Action, Panberes Cross Action and Panberes Classic for Bass Plaque Control Technique using O’ Leary Plaque Index

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Abstract

Objective: Mechanical plaque removal namely tooth brushing is the most commonly used oral hygiene technique. Efficacy of tooth brushing is influenced by the design and shape of toothbrush. This study aimed to compare the efficacy of two common Iranian toothbrushes with a foreign made one in plaque removal.

Methods: This clinical trial was conducted on 30 female dental students in Babol University, School of Dentistry using simple randomized sampling. Oral B Cross Action (Germany), Panberes Cross Action and Panberes Classic (Iran) toothbrushes were compared. Students were asked not to brush their teeth for 24 hours before the first visit. At the first visit, subjects received oral prophylactic procedures and the baseline plaque index was recorded before brushing for all subjects using O’ Leary plaque index. In order to match the conditions, Bass tooth brushing technique was instructed to subjects. Students were then randomly divided into 3 groups of 10. The subjects were provided with the three toothbrushes for use in the first, second and third weeks. The plaque index was recorded after using each toothbrush for one week. Paired t-test was used to compare the efficacy of toothbrushes in plaque removal in the same subject while ANOVA was applied for the comparison between the three toothbrushes.

Results: Significant reductions were observed in plaque index after using each toothbrush. Plaque index reduction was the highest for Oral B Cross Action and the lowest for Panberes Classic (p=0.001). Oral B Cross Action had a significant difference with Panberes Classic in mean plaque index reduction (p=0.018). Panberes Cross Action and Oral B Cross Action were not significantly different in this respect (p=0.797).

Conclusion: Oral B Cross Action and Panberes Cross Action were not significantly different in terms of plaque index reduction. However, the mentioned two toothbrushes had a significant difference in this respect with Panberes Classic.

Key words: Bass technique, Comparison, Dental plaque, Oral hygiene, Plaque control, Toothbrush.

Introduction:

Dental caries and periodontal disease are two prevalent diseases caused by the accumulation of microbial plaque and deposits on the teeth surfaces (1). Dental plaque is a dense mass of bacterial cells that forms on the subgingival and supra gingival surfaces. Microorganisms involved in dental plaque formation are associated with tooth decay and periodontal disease (2). In 1965 Loe, et al. showed a positive relationship between gingivitis and dental plaque
To date, proper oral hygiene and adequate plaque control have been the most important measures for prevention of dental caries and periodontal disease (4). Microbial plaque control is the cornerstone of treatment of periodontal diseases (5). Plaque control is defined as regular dental plaque removal and prevention of its re-accumulation on dental and gingival surfaces. Plaque control is an important component of dental treatment, ensuring long-term dental and periodontal health (6). Various tools used for mechanical plaque control include toothbrush, dental floss, toothpick and interdental brush, among which toothbrush is most commonly used (2). Various techniques of tooth brushing have been described in the literature. At present, Bass technique is considered as the most effective technique for dental plaque removal in interproximal surfaces and crevicular areas (7, 8). Various types of toothbrushes are currently available on the market, but there is no evidence to support the superiority of one model over the others. In a study by Cugini and Warren (2006), Cross-Action design was found to be more effective than the Classic toothbrush in dental plaque removal (9). Indexes are used to assess the severity and status of disease in individuals or populations. Indices are also used in the clinical setting to assess gingival status of patients and monitor the changes over time. O'Leary and Silness & Loe plaque indices are among the commonly used indices for dental plaque assessment. Each of these indices has advantages and disadvantages. Selection of an appropriate index largely depends on the researcher’s opinion and study design (10, 11). Singh, et al. in 1992 compared the efficacy of Colgate and Oral-B toothbrushes using Rustogi plaque index and showed that Colgate toothbrush was superior in reducing the plaque index particularly in the inter dental areas (12). Sharma, et al. (1992) evaluated Reach full head, Oral-B40 and Colgate toothbrushes using the Rustogi plaque index and showed that Colgate toothbrush was more effective in reducing plaque in all areas, especially the inter dental areas but the other two toothbrushes had no significant difference in this respect (13). Noorollahian and Nikravan (2005) in their study compared the clinical plaque index in two children toothbrushes using Shick & Ash plaque index; they found that the plaque index was not significantly different before and after tooth brushing with Shick and Oral-B toothbrushes (14). In our study, two popular Iranian toothbrushes and one highly popular foreign made toothbrush in Iran were evaluated in terms of plaque removal. Iranians mostly tend to use foreign made products especially toothbrushes while there is a large difference in price of Iranian versus foreign made toothbrushes. Moreover, little is known about the efficacy of Iranian toothbrushes for plaque removal compared to foreign made toothbrushes. Thus, the present study sought to compare the efficacy of Panberes Classic and Cross Action and Oral-B Cross Action toothbrushes in microbial plaque removal.

**Methods:**

In this prospective clinical trial, 30 female dental students of Babol University, School of Dentistry were selected using convenience sampling. The inclusion criteria consisted of no systemic disease, no history of drug use, no dental crowding, no severe dental malocclusion, no pregnancy, having at least 20 teeth, no fixed or removable orthodontic appliances, no toothache, and willingness to participate in the study. Oral-B Cross Action (Germany) was used as the foreign-made product and Panberes toothbrushes (Classic and Cross Action models) were used as Iranian toothbrushes in this study. There are three types of bristles in Oral B Cross Action toothbrush. Green bristles are placed obliquely and are used to remove the plaque from inter dental areas and along the gum line.
This brush is more capable of removing the plaque in backward motion compared with a flat brush. The bristles of Panberes Classic have a rounded processed tip and are considerably soft and gentle when brushing. Panberes Cross Action toothbrush has short and long hairs for cleaning the posterior teeth. The strong handle and travel caps are among the other positive characteristics of this product (15).

After obtaining written informed consent, students were asked to avoid using any oral hygiene measures for 24 hours prior to the visit. Oral prophylaxis was performed for all patients during the first visit after this period, and baseline plaque index was determined using the O’Leary index before brushing and was recorded in a special form. In order to match the conditions, the Bass tooth brushing technique was instructed to all subjects and a 2-minute brushing time was considered for them (15). The subjects were randomly divided into 3 groups of 10 each and were asked to brush their teeth with each understudy toothbrush for one week. After using each toothbrush for one week, subjects were asked to avoid brushing or any plaque removal measure for 24 hours before the recall visit. At the recall visit, after ensuring compliance with the study conditions, the plaque index of subjects was recorded using the O’Leary plaque index.

This index is calculated as follows:

\[
\text{Number of stained surfaces (except for occlusal surface)} \times 100 \\
\text{Number of existing teeth} \times 4
\]

At the end of first week, the first toothbrush was taken from subjects and they were provided with the second toothbrush and this process continued as such. Toothbrushes were used without the toothpaste to eliminate the confounding effect of toothpaste on plaque index. Participants were also advised to use less sugary foods in days that they did not brush.

The study results were recorded in specific forms and a total of 120 plaque indexes were obtained from patients; 30 indexes before and 90 indexes after brushing, including 30 indexes related to Oral-B Cross Action, 30 for Panberes Classic and 30 for Panberes Cross Action.

**Results:**

In this study, the efficacy of three toothbrushes in reducing dental plaque was evaluated within each subject in comparison with the baseline plaque index using paired t-test. ANOVA was applied for the comparison of the efficacy of the three toothbrushes. Table 1 shows the three toothbrushes that were randomly assigned for use in the first, second and third weeks.

<table>
<thead>
<tr>
<th>Week 1</th>
<th>Week 2</th>
<th>Week 3</th>
</tr>
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<tbody>
<tr>
<td><strong>Group 1 (n=10)</strong></td>
<td>Classic Panperes</td>
<td>Cross action Panperes</td>
</tr>
<tr>
<td><strong>Group 2 (n=10)</strong></td>
<td>Cross action Oral B Panperes</td>
<td>Classic Panperes</td>
</tr>
<tr>
<td><strong>Group 3 (n=10)</strong></td>
<td>Cross action Panperes</td>
<td>Cross action Oral B Panperes</td>
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</table>

Table 2 shows the mean plaque index before and after tooth brushing. As observed, the mean baseline plaque index was almost equal in the three groups. However, the mean plaque index showed a statistically significant reduction in all toothbrush groups after the intervention; and this reduction in plaque index was significantly higher for Oral-B compared to the other two groups \((p=0.001)\).

<table>
<thead>
<tr>
<th><strong>Table 2- Comparison of the mean plaque index reduction</strong></th>
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<tr>
<td><strong>Toothbrush</strong></td>
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<tr>
<td>Mean plaque index reduction</td>
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<tr>
<td>SD</td>
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</table>
ANOVA revealed a significant difference between groups; thus, Post Hoc Test was applied using Games Howell examination and found a significant difference in the mean plaque index reduction between Oral-B Cross Action and Panberes Cross Action with Panberes Classic; however, no significant difference was detected between Oral-B Cross Action and Panberes Cross Action. As shown in Table 2, reduction in plaque index was the highest in Oral-B Cross Action and the lowest in Panberes Classic ($p=0.001$). Table 3 compares the mean plaque index between each two groups. As shown in Table 3, the mean plaque index reduction was the highest in Oral-B Cross action (47.68) and the lowest in Panberes Classic (37.25). Pair wise comparison of study groups revealed that Oral-B Cross Action had a significant difference with Panberes Classic in mean plaque index reduction ($p=0.018$); however, it had no significant difference with its Iranian counterpart, i.e. Panberes Cross Action, in terms of mean plaque index reduction ($p=0.797$). In comparison between the two Iranian toothbrushes namely Panberes Classic and Panberes Cross-Action, the latter exhibited greater efficacy in reducing the plaque index ($p=0.026$).

**Table 3- Comparison of the mean plaque index reduction between each two groups**

<table>
<thead>
<tr>
<th>Toothbrush groups</th>
<th>Mean plaque index reduction</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oral B Cross Action &amp; Panberes Classic</td>
<td>47.68 &amp; 37.25</td>
<td>0.018</td>
</tr>
<tr>
<td>Oral- B Cross Action &amp; Panberes Cross Action</td>
<td>47.68 &amp; 46.71</td>
<td>0.797</td>
</tr>
<tr>
<td>Panberes Classic &amp; Panberes Cross Action</td>
<td>37.25 &amp; 46.71</td>
<td>0.026</td>
</tr>
</tbody>
</table>

**Discussion:**

In this study, the efficacy of three toothbrushes namely Oral-B Cross Action, Panberes Classic and Panberes Cross Action was compared in terms of plaque removal with the Bass technique. For this purpose, 30 volunteers alternately used the three toothbrushes. The efficacy of plaque removal was calculated for each toothbrush using the O'Leary plaque index, and the results were statistically analyzed. Participant used all three toothbrushes and served as controls for themselves. Thus, the, effect of confounding variables namely the participant’s status, performance, dexterity, motivation, trainability and oral and dental anatomy was eliminated and the results had good reliability and validity.

**Characteristics of Oral-B Cross Action toothbrush: (Figure 1)**

There are three types of bristles in this toothbrush. Green bristles are placed obliquely and are used to remove the plaque from interdental areas and along the gum line. This brush is more capable of removing the plaque in backward motion compared with a flat brush. The tall green bristles enhance the brush efficacy during movement in deep points. Indicator bristles are blue and fade to signal when to replace the toothbrush. Power tip bristles are at the head of the brush in the shape of a single tuft, providing easy access to hard-to-reach areas. A rubberized thumb grip is located at the handle allowing added control of the brush (15).

**Figure 1- Oral-B Cross Action toothbrush**

**Characteristics of Panberes Classic: (Figure 2)**

This brush is available in both medium and soft types. Both types have an indicator (about 10 tufts) that fades to signal when to replace the toothbrush. The toothbrush has a thumb grip; which improves manual control of the brush. The concave hairs are not at the same level (15).
Figure 2—Panberes Classic toothbrush

Characteristics of Panberes Cross Action:
(Figure 3)
Panberes Cross Action has 3 to 4 rows of tufts. Such toothbrushes less commonly undergo deformity and better transfer the applied forces to teeth. Thus, they are more capable of plaque removal. Its difference with Panberes Classic is in the appearance and position of the handle and arrangement of tufts (16). This toothbrush has date control to determine the three-month time period of usage (recommended by dentists). It also has short and long hairs for cleaning the posterior teeth. The strong handle and travel caps are among the other positive characteristics of this product (15).

Figure 3—Panberes Cross Action toothbrush

Evidence confirms the role of microbial plaque in the etiology of periodontal disease and tooth decay (17, 18). Among various plaque control techniques, tooth brushing has the greatest impact on removal of dental plaque and food debris and ultimately preventing dental caries and periodontal disease (18). Type of toothbrush and the brushing technique can greatly affect its efficacy. Many studies have compared toothbrushes with different designs, forms and brands (Iranian and foreign) in dental plaque reduction. These studies all have focused on the most important characteristic of toothbrush namely plaque removal. Bastiaan, et al. in 1986 (16), Gibson, et al. in 1998 (19), Singh, et al. in 1992 (12), Sharma, et al. in 1992 (13), Benson and Grossman. in 1993 (20) and Heasman, et al. in 1999 (21) compared the effect of different toothbrushes on dental plaque; Bastiaan in 1986 (16) found no significant difference in plaque reduction between the understudy toothbrushes. But Singh, et al. (1992) (12) and Sharma, et al. in 1992 (13) reported that Colgate toothbrush was superior to Oral-B. Benson and Grossman in 1986 (20) reported that Reach wonder grip toothbrush was more effective than Colgate in reducing dental plaque. This study was conducted on 30 female dental students due to their high knowledge about different methods of brushing and also their social and cultural level and this can be a strength point of this study. The study results found no significant difference between the Oral-B Cross Action and Panberes Cross Action, indicating the favorable efficacy of Iranian toothbrushes in plaque removal. In a study by Biesbrock, et al. it was indicated that regardless of the technique, tooth brushing leads to significant reduction in plaque index (22). In this line, we reached a conclusion that regardless of the brand or type of toothbrush, tooth brushing could contribute to a significant decrease in plaque index ($p=0.001$). On the other hand, our study results showed a significant difference between Oral-B Cross Action, and Panberes Cross-action with Panberes Classic, in plaque reduction which is not in accord with the results of Heasman and McCraken studies who found no significant difference between different types of toothbrushes in reducing dental plaque; they also found that electric toothbrush provided no additional benefit (23, 24). However, our findings are in agreement with those of Terezhalmy, et al. (2005), Cugini and Warren (2006), Dorfer, et al. (2009), and Haffajee, et al. (2001) studies in which the superiority of certain types of toothbrushes over other types was emphasized (6, 9, 10, 25). Such difference may be attributed to differences in the shape and design of toothbrushes and the study design. In a study by Cugini, et al. (2006) Oral-B Cross Action was shown to have superior standard features over Colgate Navigator and Crest Spin Brush Pro (26). Greater plaque removal efficacy of Dr. SEDOC toothbrush was reported by
Babaie, et al. (2004) compared with ADA standard control (27). In a research by Haun, et al. (2002) on electric and manual toothbrushes, electric toothbrushes were found to be more efficient than the manual ones in eliminating dental plaque; however, Oral B Cross Action showed higher efficacy in the manual toothbrush group (28). Singh, et al. (2001) found that Colgate Total Professional toothbrush was more efficient than Oral-B Cross Action in reducing the plaque and gingivitis. Considering all the above, it can be stated that toothbrush as one of the main tools for mechanical plaque removable causes a significant reduction in dental plaque; this point highlights the necessity of regular brushing (p= 0.001). Since our obtained results are different from the findings of mentioned studies, further investigations are required in this respect (29). It is worth-mentioning that the type of toothbrushes evaluated in the above-mentioned studies was different from those of our investigation. However, researchers have mainly evaluated the standard toothbrushes, and Panberes Cross Action, according to the manufacturer’s claim, has the characteristics of a standard toothbrush. Also, its price is much lower than the similar foreign products. Thus, its use is cost-effective for patients in comparison with Oral-B Cross Action and has a comparable function as well. Moreover, recent studies have emphasized on the greater role of tooth brushing on reducing the risk of gingivitis and stated that its role in reducing gingivitis is clinically more valuable than its role in plaque reduction; because plaque reduction by a special type of toothbrush does not necessarily reduce gingivitis. But, since plaque control is an important part of dental treatment and can guarantee the long-term dental and periodontal health, studies on this subject can greatly help increase the success rate of dental treatments which is the main concern of dentists.

Conclusion:


Study Limitations:

Non-compliance of some of the participants and ethical considerations due to not brushing for 24h were among the limitations of this study.

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Conflict of Interest: “None Declared”

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