

Research Paper: Effect of an Iranian Toothpaste Compared with a Commonly Used Foreign-Made Toothpaste on Plaque Index of 9- to 12-Year-Old children: a clinical trial



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ABSTRACT

Introduction: Mechanical plaque removal is the most reliable method of oral hygiene practice. However, to maximize its effect, it should be accompanied by the use of chemical agents such as toothpastes, mouth washes and fluoride gels. This study aimed to compare the effect of tooth brushing with an Iranian toothpaste compared to a commonly used foreign-made toothpaste on plaque index (PI) of 9- to 12-year-old children.

Materials and Methods: This randomized single-blind crossover clinical trial was conducted on 26 children between 9 to 12 years old. Participants were randomly divided into two groups. The difference between the two study groups was the order of Bas and Crest toothpaste application. Dental prophylaxis were done for all teeth to reduce PI score to zero. The children were then requested to brush their teeth with the first toothpaste and use dental floss before going to bed for one week. At the end of the first week, Turesky's PI was measured. After a one-week washout period, the PI was reached to zero again and the toothpaste was changed and participants used the second toothpaste for one week. PI was measured again and the values were compared using paired t-test ($\alpha=0.05$).

Results: The mean PI in "Bas" toothpaste group (1.486 ± 0.398) was significantly higher than that in "Crest" toothpaste group (1.256 ± 0.229) ($P=0.014$).

Conclusion: The results showed that "Crest" toothpaste was significantly more effective for plaque control than "Bas" toothpaste in our study population.

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Introduction

Dental plaque is the main etiology of dental caries and gingivitis (1-3). Prevention of dental caries and periodontal disease and treatment of these conditions in patients are the main goals of oral health strategies (4). Therefore, plaque control is imperative to maintain oral hygiene and prevent dental caries and periodontal disease (1,5).

Mechanical plaque removal methods such as tooth brushing and dental flossing are the most accepted techniques for dental plaque control (6). Tooth brushing is the most common method of oral hygiene maintenance and it has been shown that tooth brushing twice daily can significantly decrease the prevalence of caries and periodontal disease (6,7).

Although mechanical plaque control is the most reliable method of oral hygiene maintenance and chemical ingredients cannot be a substitute for brushing the teeth but its effect can be maximized by the use of chemical agents such as toothpastes, mouthwashes and fluoride gels (1,2). Most individuals do not have the required level of expertise for efficient tooth brushing and dental flossing. Thus, they cannot well maintain their oral health. Chemical compounds can help in better plaque control (8). Toothpastes are commonly used for prevention of plaque formation and gingivitis (2).

Toothpastes contain abrasive agents, detergents, moisturizers and flavors. Also, toothpastes contain anti-plaque compounds such as chlorhexidine, stannous fluoride, sodium bicarbonate, hydrogen peroxide and triclosan. Triclosan is the most important anti-plaque and anti-gingivitis component incorporated into the formulation of toothpastes (2,3).

Considering the high prevalence of dental caries in children worldwide and also in Iran (3) and the related costs of treatment of this condition as well as the priority of prevention to treatment, study of different methods of caries prevention and their efficacy is a research priority.

Not many studies have evaluated the efficacy of Iranian toothpastes. Some available studies have shown significant reduction of dental

plaque and gingival inflammation in use of foreign-made toothpastes to compare with Iranian toothpastes (3,9) while some others failed to show any superiority for the foreign-made toothpastes (10,11). Thus, controversy exists in the results of previous studies on this topic. "Bas" is a commonly used Iranian toothpaste. However, studies on its efficacy are scarce. Moreover, the manufacturer provides various products for specific age groups, which need to be studied in terms of effectiveness. "Crest Complete" is also a commonly used toothpaste in the Iranian market (12). The afore-mentioned two toothpastes have almost similar concentration of fluoride.

This study aimed to compare the effect of Bas and Crest Complete toothpastes on plaque index (PI) of 9- to 12-year-old children.

Materials and Method

This single-blind cross-over clinical trial was conducted on 26 children between 9 to 12 years. The study was approved in the ethics committee of Guilan University of Medical Sciences (code: IR.GUMS.REC.1394.295) and registered in www.irct.ir (code: [irct2015112925279N1](http://www.irct.ir)). Sample size was calculated to be 26 according to a study by Lakade et al, (13) assuming standard deviation of 0.163 and $d=0.4$. The participants were chosen among students in four elementary schools in Rasht city using cluster sampling method. Parents of students were briefed about the study and signed informed consent forms.

The inclusion criteria were good oral hygiene (tooth brushing twice daily with use of fluoridated toothpaste) and having at least five teeth in each quadrant. By the time children reach 9 years old, they can brush their teeth independently. The exclusion criteria were systemic diseases affecting the secretion or composition of saliva or dental plaque, use of antibiotics in the past one month, allergy to toothpaste components, having active carious lesions or crowns in their oral cavity, having orthodontic appliances, presence of periodontal pocket deeper than 3 mm and exfoliation of teeth during the washout period.

Participants were randomly divided into two groups. The difference between the two study

groups was the order of Bas and Crest toothpaste application. Group 1 used Bas (Tehran, Iran) toothpaste first while group 2 used Crest Complete (Crest, Germany) first. Both toothpastes were adult toothpaste. For the purpose of standardization, each participant received a soft

bristle Oral-B toothbrush (Oral-B 123 classic care, Ireland) and a dental floss (Orkid, Tehran, Iran). The composition and application procedure of Crest and Bas toothpastes have mentioned in table 1.

Table 1. The composition and application procedure of Crest and Bas toothpastes.

Group	Material	Composition	Application procedure
Crest	abrasives	Silica	Mechanically cleanse the tooth
	Humectants	Sorbitol	Maintain the moisture and prevent hardening
	Soap	Sodium lauryl sulfate	Remove the loosened material
	Therapeutic agents	Sodium Fluoride Zinc citrate	Prevent diseases
	Binding agent	Cellulose	Prevent the solids tend to settle out of the paste
	Sweetening agent	Sorbitol	For taste acceptance
	Bas	abrasives	Silica
Humectants		Sorbitol	Maintain the moisture and prevent hardening
Soap		Sodium lauryl sulfate	Remove the loosened material
Therapeutic agents		Sodium monofluoro phosphate Triclosan	Prevent diseases
Binding agent		Carboxymethyl cellulose	Prevent the solids tend to settle out of the paste
Sweetening agent		Sorbitol	For taste acceptance

Also, for the purpose of standardization of technique of tooth brushing, correct tooth brushing method was instructed to participants and their parents on a model and then their O'Leary's PI (14) was reached to zero by dental cleaning and prophylaxis using a low-speed hand piece and a prophylaxis brush. Participants and their parents were instructed to brush their teeth with the respective toothpaste using the horizontal scrubbing technique with 1 cm of the toothpaste length on the toothbrush for three minutes under the supervision of parents twice daily (in the morning after breakfast and at night before going to bed) for one week. Also, they were requested to floss their teeth every night and refrain from using any other oral hygiene product such as mouthwash. The parents were also requested to only supervise children and do not interfere or aid them in this process.

At the end of the first week, PI was measured again. On the day of clinical examination, chil-

dren were asked to brush their teeth without toothpaste and drink a glass of water prior to examination for the purpose of standardization.

After calibration, the examiner (Final year student of dentistry) disclosed the supragingival plaque using plaque indicator (GC, Tokyo, Japan) and scored the amount of dental plaque using Quigley-Hein index, Turesky modification (15). This indicator revealed sites of plaque accumulation. Mature plaque, present on the tooth surface for more than 48 hours, stained blue while the new plaque stained pink. Using a micro-brush, the plaque indicator gel was applied on the buccal and lingual surfaces of all teeth and they were then requested to wash their teeth.

The scoring of PI according to the Quigley-Hein index, Turesky modification (15) was as follows:

0: Absence of plaque

1: Scattered points of dental plaque in the cervical margin

2: A thin, continuous band of plaque in the

cervical margin (as wide as 1 mm)

3: A band of plaque with more than 1 mm width covering less than one-third of the crown

4: Plaque covering a minimum of one-third and less than two-thirds of the crown

5: Plaque covering more than two-thirds of the crown

The mean PI for each individual was calculated by adding all the values divided by the number of assessed sites.

A one-week washout period was considered to prevent the effect of the previously used toothpaste on the results of the next one. During the washout period, none of these two toothpastes was used. In this period children used the toothpaste they used before the examination.

After the washout period (third examination session), the O'Leary's PI was reached to zero and then the toothpaste was changed. Participants used the assigned toothpastes the same as before and after the third week, PI was measured again.

Since we could not mask the tubes, double blinding was not possible and our study had a single blind design such that the examiner was not aware of the type of toothpaste used by the participants. Due to the crossover design of the study, both groups used both types of toothpastes. Thus, each individual was compared with himself/herself and therefore, quality of tooth brushing, anatomy of the oral cavity, leveling and alignment of teeth, the efficiency of tooth brushing, motivation of patients for tooth brushing and other personal factors affecting plaque control had no effect on the results. The Bas users were considered as the test and the Crest users were considered as controls.

Data were analyzed using SPSS version 21 (SPSS Inc., IL, USA). Normal distribution of data was evaluated using the Shapiro-Wilk test. The test (Bas users) and control (Crest users) groups were compared using paired t-test. One-way ANOVA was then applied to analyze the mean PI scores in different age groups.

Results

A total of 26 students with a mean age of 10.04 ± 0.774 years (range 9-12 years) were evaluated.

The Shapiro-Wilk test showed that the data in both test and control groups had normal distribution ($P=0.055$ for the test and $P=0.096$ for the control group).

The mean plaque index was 1.486 ± 0.398 in the test and 1.256 ± 0.229 in the control group (Table 2). The mean PI in the test group was significantly higher than that in the control group ($P=0.014$).

Table 2. Comparison of mean PI in the test and control groups

Group	Number	Mean \pm SD	P-value
Case	26	1.486 ± 0.398	0.014
Control	26	1.256 ± 0.229	

Discussion

This study compared the effect of Crest Complete and Bas toothpastes on PI and showed that Crest Complete was significantly more effective than Bas in this regard.

Crest Complete toothpaste used in this study is a standard toothpaste approved by the American Dental Association and American Food and Drug Administration (12).

In our study, the teeth were cleaned by prophylaxis brush prior to the intervention. A previous study showed no significant difference at 96 hours after using the products (9). Thus, we measured PI one week after using each product, which appears to be a suitable assessment time point based on a previous study (1,16). According to our results, the highest mean PI was noted in 11-year-olds in the test and the control group. In both groups, 12-year-olds had the lowest mean PI. It could be related to presence of loose deciduous molar teeth and eruption of premolars in range of 10 to 11 years old. When children reach the age of 12 all permanent teeth are fully erupted.

Mofid et al, (9) in a previous study evaluated the effect of Nasim and Pooneh Iranian tooth

pastes compared to Complete Crest on PI and showed that Crest was superior to the two Iranian toothpastes for plaque control; their results were in agreement with ours. Monzavi et al. (17) also showed that Crest and Signal toothpastes were more effective than Pooneh, Nasim, Paveh and Darougar Iranian toothpastes for plaque control.

Rashidian et al. showed that Darougar Iranian toothpaste was as effective as Colgate for plaque control in children but Kaam Iranian toothpaste was less effective than Colgate, which was in line with our result (10).

Sadeghi et al. (6) showed that Bas and Pooneh Iranian toothpastes had similar antimicrobial activity as Crest Cavity Protection toothpaste but other Iranian toothpastes tested in their study had significantly less antimicrobial activity compared to Crest, although their antimicrobial activity was higher than that of water.

Difference between toothpastes is attributed to their different formulations. Abrasive agents and detergents are also present in the composition of toothpastes. Abrasive agents have long been incorporated into the composition of toothpastes to eliminate the collagen matrix of the plaque and decrease the microbial plaque (3). Both toothpastes in our study were similar in terms of the amount and type of abrasive agent (silica).

It has been claimed that detergent can also penetrate into dental plaque and dissolve it and thus, whiten the tooth surface. Moreover, the soaping effect of detergent can enhance elimination of plaque by weakening its bond to tooth surface (10). Detergent present in the composition of Crest Complete and Bas toothpastes is sodium lauryl sulfate, which has antimicrobial and anti-plaque properties (9). Since the detergent present in both toothpastes is the same, significant difference between them may be related to the bond of detergent with other components since detergent may lose its anti-plaque property in combination with other components (3).

Also, since sodium lauryl sulfate and silica are present in the composition of both toothpastes, difference in concentration of different compounds not disclosed by the manufacturer may also explain the significant

difference in the efficacy of the two toothpastes (10). For instance, the concentration of sodium lauryl sulfate, commonly used as detergent, may be variable in different toothpastes causing different levels of efficacy (10).

One difference between the formulation of Bas and Crest is presence of zinc citrate in the formulation of Crest toothpaste. Toothpastes containing metal salts have long been known to have anti-plaque properties. Zinc and stannous salts are commonly used for this purpose since they are safe while having antimicrobial activity (18).

Evidence shows that zinc and sodium lauryl sulfate have synergistic antimicrobial activity. Also, according to Giertsen, combination of zinc citrate and sodium lauryl sulfate causes further decrease of PI (19). Some other studies also confirmed this (20,21).

When assessing toothpastes with anti-plaque properties, it should be kept in mind that fluoridated products have some degrees of anti-plaque activity when compared to placebo. Crest toothpaste, showing higher efficacy for plaque control, had sodium fluoride while Bas toothpaste had monofluorophosphate. Thus, higher efficacy of Crest may be attributed to the type of fluoridated compound in its composition as well (9,10).

A few limitations of the study may be pointed out. First is that the composition of Bas and Crest are different, which can affect the antibacterial activity of these toothpastes. Also the taste of toothpastes were different. As it wasn't possible to unify the toothpaste tubes, the participants were aware of the treatment allocation and the study was designed under single blind condition which considered as a limitation in our study. Further studies on the efficacy of Iranian toothpastes and their effect on main cariogenic bacteria are required.

Conclusion

Within the limitations of this study, the results showed that Crest toothpaste was significantly more effective for plaque control than Bas toothpaste after one week of use in our study population.

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Conflict of interests:

Authors have no conflict of interests.

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