

Original Research**Comparison of the efficacy of four different tooth brushes bristle tip design in plaque removal: a randomized, double blind, concurrent parallel design study****Lalitha B. Shiggaon¹, Amol R. Agrawal², Mayur A. Dhavan³, Alka S.Waghmare⁴, Rinnu Alex Mathew⁵, Shilpa Ashokkumar Fotani⁶**¹ Reader, Dept. of Periodontics, JMF's ACPM Dental college and hospital, Dhule^{2,3,5,6} Post graduate student, Dept. of Periodontics, JMF's ACPM Dental college and hospital, Dhule⁴ Professor and HOD, Dept. of Periodontics, JMF's ACPM Dental college and hospital, Dhule

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ABSTRACT

Plaque is the major etiology of periodontal disease and dental caries. Daily plaque removal is critical for long term success of all periodontal and dental treatment. Soft bristles brush with modified bristles tip designs shows better plaque removal and less gingival trauma.

Aims: To compare the efficacy of four different tooth brushes bristle tip design in plaque removal.

Methods and material: The study was a randomized, double blind concurrent parallel design. 40 subjects aged 20-22 years participated in the study. The subjects were rendered plaque free and were asked to suspend oral hygiene practices for 24 hours. On day 2, the subjects were scored for plaque prior to brushing using the Quigley-Hein plaque index. The subjects then brushed with the allocated toothbrush for 2 minutes and the post-brushing plaque scores were assessed. Further subjects were recalled twice at an interval of 4 days for plaque scoring.

Statistical package for social sciences (SPSS), 17.0 Software was used. Paired t test and one way ANOVA test were used.

Results: During all the 3 test periods the sensodyne toothbrush with standard round end tip bristles showed better plaque removal followed by Tri-tip, Colgate 360 floss tip and Colgate slim soft.

Conclusion: The Brush B showed a slightly greater reduction in plaque when compared to the other three brushes.

INTRODUCTION

Plaque is the major etiology of periodontal disease and dental caries. Therefore daily plaque removal is critical to long term success of all periodontal and dental treatment. Plaque growth occurs within hours and must be completely removed at least every 48 hours in healthy subjects & every 24 hrs in periodontitis patients to prevent inflammation.¹

Today, toothbrushes have come up with different modification in their bristles, head, texture over the period of time. Different designs of toothbrush like two-headed, triple-headed, V-shaped bristles, multitufted, circular, Two-level, curved, circular and Diamond, hard

texture, medium texture, soft, ultra-soft are available.²

Past studies have concluded that medium textured brush shows better plaque removal than soft textured brush.³ But the soft texture toothbrush presents no gingival trauma which was seen with medium textured toothbrushes.^{4,5}

So, now-days soft textured toothbrushes have come up with modification in their bristles tip design for better plaque control.

There are no studies which compare bristles tip designs in soft textured tooth brushes till date. So, this article aims at comparing soft textured brushes with different bristles tip design in plaque removal.

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Materials and methods: The study includes 40 systemically healthy both male and female subjects of age group 20-22 years with minimum of 25 intact teeth. Informed consent was taken from the participants before starting the study. Subjects with periodontitis, ongoing orthodontic treatment, and history of antibiotic usage at least two weeks prior to the study were excluded.

Four different types of commercially available manual toothbrushes were selected for the study. These brushes differed in their pattern of bristles tip design. The four toothbrushes were
 Group A) Colgate Slim soft (17x slimmer tip)
 Group B) Sensodyne round end tip
 Group C) Colgate tri-tip
 Group D) Colgate 360 Floss-tip
 All these brushes were of soft textured bristles.

The study was randomized double blind concurrent parallel design study in which the subjects were randomly allocated with toothbrushes. Subjects and examiners were blinded to the toothbrush assigned by coding the toothbrushes as A, B, C, D. All the subjects entered the study at the same time.

Modified bass technique of tooth brushing was taught to all subjects before starting the study. Oral prophylaxis was carried out on the first day of each test period to rendered the subjects plaque free and were then asked to refrain from oral hygiene practices for 24 hours. On day two, the subjects were assessed for plaque prior to brushing by using Turesky and Gilmore index (modification of Quigley-Hein plaque index). Plaque was assessed on the buccal and lingual surfaces of all teeth except the third molars using the erythrosine disclosing solution. The subjects were then allocated the toothbrushes and were asked to brush for 2 minutes, following which they were rescored for plaque using the same index. The same

procedure was followed during test periods 2 and 3. A wash-out period of 4 days was allowed between the study periods, during which the subjects returned to normal oral hygiene practices with the same brushes which were allocated to them.

Mean plaque index for each subject was calculated by adding all the individual plaque scores (two per tooth) and dividing the sum by the total number of surfaces examined and they were subjected for statistical analysis.

Results- Total of forty dental students participated in present study with equal number of male (20) and female (20) distribution in age group of 20 – 22 years and the mean is 21.

The mean plaque pre-brushing score **at test period 1** for group A,B,C,D were 2.025, 2.182, 1.417 & 1.992. The mean post brushing score at test period 1 were 0.694, 0.598, 0.419, 0.662

The intra group mean plaque reduction scores from prebrushing to post brushing 1.33, 1.58, 0.99, 1.33 were statistically significant at P (0.001) (table-1).

However the comparison of intergroup mean plaque removal scores for test period 1 was not statistically significant with p value (0.139) (table-2)

At test period 2 the mean pre-brushing plaque score for group A, B, C & D were 1.843, 2.096, 1.113 & 1.802 (table 3)

The mean post-brushing plaque score for group A, B, C & D were 0.578, 0.502, 0.308 & 0.538 respectively.

The intra group comparison of mean plaque reduction score for group A, B, C & D at test period 2 were 1.27, 1.59, 0.81 & 1.26, showed statistically significant with p value (0.001)

Table No. 1: Comparison of pre and post plaque removal efficacy for test period 1

Interval	Mean Plaque Score	Std. Deviation	Mean difference	t value	p value
Slimsoft Pre	2.025000	.5603620	1.33	7.505	0.001*
Slimsoft Post	.694000	.3388608			
Sensodyne Pre	2.182000	.6586822	1.58	8.744	0.001*
Sensodyne Post	.598000	.3056432			
Tri tip Pre	1.417000	.5001566	0.99	6.310	0.001*
Tri tip Post	.419000	.2017397			
360 floss Pre	1.992000	.5152303	1.33	7.778	0.001*

Table No. 2: Comparison of mean plaque removal scores for test period 1

Group	Mean Difference	Std. Deviation	F value	p value
Slimsoft	1.331000	.5608416	1.949	0.139
Sensodyne	1.584000	.5728525		
Tri Tip	.998000	.5001733		
360 Floss	1.330000	.5407402		

Table No. 3: Comparison of pre and post plaque removal efficacy for test period 2

Interval	Mean Plaque Score	Std. Deviation	Mean difference	t value	p value
Slimsoft Pre	1.843000	.5214946	1.27	7.612	0.001*
Slimsoft Post	.5780	.36070			
Sensodyne Pre	2.096000	.6329332	1.59	8.785	0.001*
Sensodyne Post	.502000	.2877422			
Tri tip Pre	1.113000	.2711314	0.81	10.156	0.001*
Tri tip Post	.308000	.1585910			
360 floss Pre	1.802000	.4086781	1.26	8.360	0.001*
360 floss Post	.538000	.1971350			

Table No. 4: Comparison of mean plaque removal scores for test period 2

Group	Mean Difference	Std. Deviation	F value	p value
Slimsoft	1.265000	.5255315	4.690	0.007*
Sensodyne	1.594000	.5738021		
Tri Tip	.805000	.2506547		
360 Floss	1.264000	.4781260		

Table No. 5: Comparison of pre and post plaque removal efficacy for test period 3

Interval	Mean Plaque Score	Std. Deviation	Mean difference	t value	p value
Slimsoft Pre	1.832000	.5335166	1.31	6.712	0.001*
Slimsoft Post	.522000	.3480677			
Sensodyne Pre	2.032000	.5750903	1.65	10.306	0.001*
Sensodyne Post	.381000	.1874656			
Tri tip Pre	.918000	.2598632	0.71	10.870	0.001*
Tri tip Post	.205000	.1074192			
360 floss Pre	1.674000	.4103711	1.22	8.388	0.001*
360 floss Post	.450000	.0987702			

Table No. 6: Comparison of mean plaque removal scores for test period 3

Group	Mean Difference	Std. Deviation	F value	p value
Slimsoft	1.310000	.6172160	6.727	0.001*
Sensodyne	1.651000	.5066107		
Tri Tip	.713000	.2074207		
360 Floss	1.224000	.4614277		

Figures:

Figure 1: Colgate Slim soft (17x slimmer tip)



Figure 2: Colgate tri-tip

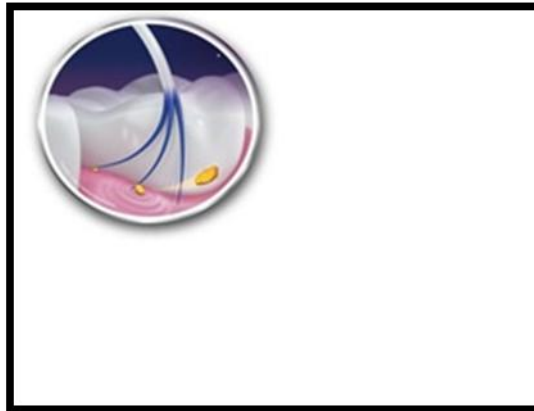
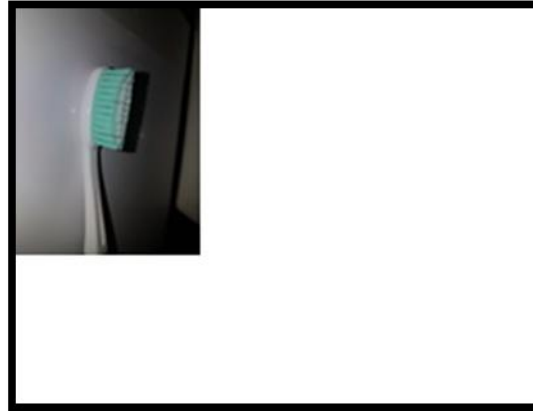


Figure 3: Colgate 360 floss-tip



Figure 4: Sensodyne round end tip



The inter group comparison of mean pre-brushing plaque reduction score for group A,B,C & D were statistically significant with p value 0.007 (table 4)

At test period 3 the mean pre-brushing plaque scores were 1.832, 2.032, 0.918 & 1.674 and post brushing plaque scores were 0.522, 0.381, 0.205 & 0.450 (table 5).

The intra group mean difference in plaque reduction for A, B, C & D group is 1.310, 1.651, 0.713 & 1.224 with p value 0.001 which is statistically significant.

The inter group comparison of mean plaque removal score for group A,B,C & D were statistically significant with p value of (0.001) respectively.

During all the 3 test periods the sensodyne toothbrush with round end tip bristles showed better plaque removal, next was Tri-tip, followed by Colgate 360 floss tip and Colgate slim soft

Discussion:

There is a general agreement that a positive correlation exists between bacterial plaque on the tooth surfaces and gingival inflammation. The strong association of plaque with gingivitis was revealed in several epidemiological surveys.⁶ Mechanical plaque control is the most important strategy to prevent periodontal disease and manual toothbrushes are the most frequently used devices. Tooth brushing plays a

pivotal role in the defense against plaque and gingivitis.

The efficacy of tooth-brushing is depend on number of factors such as time devoted to brushing, hand pressure, manual dexterity, patient motivation, brushing technique and also by the index used to measure plaque.⁷

Use of the bristle toothbrush was started during the 18th century. Forerunners of today's brushes were developed in the 1930s. These nylon toothbrushes with plastic handles were easy to manufacture and therefore more affordable, making tooth brushing a common practice in Western society. Since then, many modifications has been made in toothbrush design, and today numerous designs of manual toothbrushes are available in market.⁸

Today modern toothbrushes have different bristle tuft arrangements (e.g., flat-trim, multilevel, angled) which are designed to enhance plaque removal from hard-to-reach areas of the dentition, particularly from interproximal areas.⁹

It has been consistently concluded by several workshops and reviews that there is no superior design of manual toothbrush, yet different companies are coming out with different designs, each claiming superiority, backed by the results of their own clinical research teams.^{7, 10, 11}

The soft-bristled brushes that are ADA

approved are end-rounded. Round-ended bristles are recommended because they have been shown to cause 30% to 50% less soft tissue trauma.¹² But as they are hard to reach in interproximal and crevicular areas, modification in their bristles tip designs has been taken place.

In the present study all the toothbrushes showed statistically significant for mean difference in pre-brushing plaque score to post brushing at all test periods which shows that toothbrush are effective in reduction of plaque with p value of (0.001).

The inter group comparison of plaque removal of tooth brushes showed significant differences which means the bristles tip influencing negatively on the plaque removal showing the standard round tip bristles was more efficient compared to tri-tip, slim soft, floss tip bristle tip modification in tooth brushes.

The results were in contrast to study conducted by John Gallob et al. In this study they compared tapered tip bristles with ADA toothbrush, results showed tapered tip bristles is effective in plaque removal compared to ADA toothbrush.¹⁶ Also Dorfer et al found that the tooth brushes with tapered filament showed significant higher plaque removal to those filaments with standard flat trim.¹⁷

In our study we compared all types of bristles tip modification with standard round end bristle tip, the results show that none of the bristle tip modification was better than the round end tip. These observations are in accordance with these authors Leonardo Stephan Caporossi et al, Versteeg et al.^{18, 19}

The reason for this may be the bristle tip action is same as ultrasoft toothbrush as the diameter decreases, the stiffness of filament decreases resulting in decreased plaque removal though they can reach the deeper areas.¹⁴

Conclusion: In the present study, the Brush B showed a slightly greater reduction when compared to the other three brushes. The results of the present study showed that all four

brushes were effective in reducing the plaque scores.

Tooth brushing continues to be the most widely used form of oral hygiene practice in the world. But any bristle tip design alteration has not resulted in better plaque removal.

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