

# Comparison of different tooth brushes on the degree of plaque removal

Santosh Kumar Verma<sup>1</sup>, Nitesh Sharma<sup>1</sup>, Swati Singh<sup>2</sup>, Md. Ahsan Razi<sup>2</sup>

<sup>1</sup>Dental Institute, Department of Periodontics, RIMS, Ranchi, Jharkhand, <sup>2</sup>Department of Periodontics, Hazaribag College of Dental Sciences and Hospital, Hazaribag, Bihar, India

## ABSTRACT

**Background:** At present, different designs of tooth brushes are available, each one is being claimed to be the best by their manufacturers. There is a need to compare the plaque removal efficacy of the most popular designs. **Aim:** The aim of the present study was to compare the degree of plaque removal obtained with the use of two commercially available tooth brushes with round ended and thinner tip bristles. **Materials and Methods:** The study involved 60 subjects within age range 18–40 years, randomly distributed into 2 groups, 30 in each: Group A- round ended bristle, Group B- thinner tip bristle. Turesky, Gilmore, Glickman Modification of Quigley-Hein Plaque Index, (1970), (PI) was assessed at baseline, 2 weeks, 4 weeks, and 6 weeks; and Muhlemann and Son, (1971), Sulcus bleeding index (SBI) at baseline and 2 weeks were assessed in each subject. Scaling was done at 2<sup>nd</sup> week, 4<sup>th</sup> week, and 6<sup>th</sup> week after assessment of parameter. At 4<sup>th</sup> week the subjects were switched over to another type of brush for crossover evaluation. **Results:** Over 2 weeks, both the groups showed significant ( $P < 0.05$ ) reduction in plaque score, better reduction in Group A with mean differences of 0.48 than 0.41 in Group B, though it was insignificant on intergroup comparison ( $P = 0.09$ ). There was reduction in SBI in both groups with mean difference of 0.50 in Group A and 0.11 in Group B and this was statically insignificant. But on comparison, between the two groups at 2 weeks, statically significant reduction was there in Group A. Brushing with specified brush, after scaling, at 4<sup>th</sup> week Group A had significantly better plaque control ( $P < 0.01$ ). Upon crossover analysis, better efficiency of round ended bristles was observed but it did not reach the significance level ( $P = 0.126$ ). **Conclusion:** Within the limitations of the study, the data derived from the study show that both the toothbrushes had shown decrease in plaque scores. Round ended bristles were more efficient.

**Keywords:** Plaque removal, round ended bristle, thinner tip bristle, toothbrush bristle

## Introduction

Dental plaque is considered as a prime etiological factor in establishment of gingivitis which may eventually lead to periodontitis.<sup>[1]</sup> The bacterial plaque initiates an inflammatory process in the supporting structures of tooth, and if allowed to continue, ultimately may lead to loss of teeth. Hence, the health of periodontal tissues depends on effective plaque removal. Of all the mechanical methods, plaque removal using mechanical

tooth brushes stand to be primary beneficial home care method.<sup>[2]</sup> The toothbrush is an oral hygiene instrument used to clean the teeth and gums that consists of a head of tightly clustered bristles mounted on a handle, which facilitates the cleansing of hard to reach areas of the mouth.

Toothbrushes and dentifrices are widely used for cleaning the teeth. Patients without any professional advice usually choose brushes depending on its cost, availability, habit, and advertising claims. However, varying bristle patterns made different types of brushes flooded into the market claiming for better plaque removal efficacy. This may leave common man in quandary in selecting a toothbrush for which usually they

**Address for correspondence:** Dr. Santosh Kumar Verma, Dental Institute, Department of Periodontics, RIMS, Ranchi, Jharkhand, India.

E-mail: designmypaper@gmail.com

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may seek a professional advice. With the constant development in new designs, the knowledge of dental professionals should be upgraded for providing a better solution for the patients. Various studies were conducted in testing the plaque removal efficacy of manual toothbrushes. In this background the present study was planned to conduct a study to compare the efficacy of two differently designed Colgate slim soft and stim unique toothbrushes efficacy on plaque removal. This could be beneficial for the general public to select the more efficacious toothbrush among all the commercially available toothbrushes.

## Materials and Methods

The treatment protocol and detailed procedures were explained to the subjects in their own language and their signed consent was obtained. A total of 30 subjects comprising of both sexes, from outpatient department (OPD) of periodontics of Hazaribag College of Dental Sciences and Hospital, Hazaribag, Jharkhand on the basis of following criteria:

### Inclusion criteria

1. Age between 18 and 40 years.
2. Subjects with evident plaque. Plaque-index (Quigley Hein, 1970) score between 1 and 5.
3. Patient definite clinical evidence of gingivitis, Gingival Bleeding Index (Muhlemann and Son 1971).
4. No periodontal therapy in last 6 months.
5. Having a minimum of 28 natural teeth.

### Exclusion criteria

1. Medically compromised patients.
2. Mentally disabled and physically handicapped subjects.
3. Pregnant women or lactating mothers.
4. Subject with any disorder.
5. Disease severity requiring periodontal therapy other than scaling.

Selected subjects were randomly divided in two groups, group A, and Group B by chit method on the basis of toothbrush provided. Randomization was done as follows: A chit box was prepared containing 30 small bits of paper: 30 bits with Group A representing round ended bristle toothbrush, 30 bits with Group B representing Thinner tip bristle toothbrush. Subjects were asked to pick one of the folded paper bits to decide the type of brush to be given at the first visit. Plaque index (PI) and Sulcus bleeding index (SBI) were recorded. The subject was asked to do the toothbrushing as he was doing before and was recalled after 2 weeks. On second visit, after 2 weeks, PI and SBI were recorded and scaling was done. No other instructions were given recording tooth brushing technique and were advised to use the same tooth brush, paste and recalled again after 2 weeks. At this third visit, PI was recorded again and then plaque score was done zero by scaling.

Round ended bristle toothbrush was replaced with thinner tip bristles toothbrush and instructed to do the brushing as he was

doing previously with the same toothpaste provided and recalled after 2 weeks. At this fourth visit, PI was recorded again and scaling was done. The same process was repeated with Group B. At second visit, PI and SBI were recorded, and scaling was done. After 2 weeks i.e. at the third visit, subject was recalled and brush was replaced with other tooth brush with reading recorded then scaling done. Finally, subject was recalled for the last visit after 2 weeks and scaling was performed with reading noted.

## Results

The data were analyzed by SPSS (21.0 version) and presented using Tables and Graphs. They were normally distributed as tested using the Shapiro-Wilk W test. Level of statistical significance was set at  $P$  value less than 0.05\*. *Post Hoc* Tukeys test was used for pair wise comparison of subgroups.

The independent  $t$  test was used to compare plaque index scores at baseline and 2 weeks in between the groups. It failed to reach the level of significance at baseline. It ensured comparability among groups at base line. After 2 weeks, reductions of 0.48 and 0.41 were observed in Gr A and Gr B, respectively. But the PI values in the two groups at 2 weeks also, when compared, were insignificant. The paired  $t$  test was used to compare plaque index scores at baseline and 2 weeks among the groups. It reached the level of significance i.e. the plaque scores significantly decreased for both the groups after 2 weeks of using those brushes. At the completion of 2 weeks, scaling was done to eliminate local deposits and Plaque score was made zero. Subjects were asked to continue the same brush for another 2 weeks PI was re-recorded.

The changes in plaque scores at 4 weeks was compared using independent  $t$  test between groups, the difference reached the level of significance reflecting better plaque control in Group A with REB brushes. After recording the PI at 4<sup>th</sup> week, scaling was done to make the PI zero, and types of brushes were changed to each individual of each group. At the end of another 2 weeks, PI was noted. The changes in plaque scores at 6 weeks was compared using paired  $t$  test among groups, the difference did not reach the level of significance.

The independent  $t$  test was used to compare Sulcus Bleeding Index scores at baseline and 2 weeks among the groups. At baseline, the Sulcus Bleeding Index scores were statistically insignificant. It ensured comparability among groups. At 2 weeks, significant differences were found between the groups with Group A showing significantly less gingival scores than group B. The paired  $t$  test was used to compare Sulcus Bleeding Index scores at baseline with 2 weeks among the groups. It failed to reach the level of significance.

The changes in plaque scores at 2 weeks from baseline were compared using independent  $t$  test among groups, the differences failed to reach the level of significance. The changes in gingival scores at 2 weeks from baseline was compared using independent  $t$  test among groups, the difference reached the level

**Table 1: Comparison of Plaque Index between two groups at baseline 2, 4 and 6 weeks**

Groups	Baseline Mean±SD	2 Weeks Mean±SD	Mean difference	Independent t-test P (Intra-group) Baseline to 2 weeks	4 weeks Mean±SD	6 weeks Mean±SD
Group A Round ended bristle (REB)	2.78±0.57	2.31±0.44	0.48	0.00*	1.63±0.46	1.47±0.38
Group B Thinner tip bristle (TTB)	2.96±0.42	2.54±0.60	0.41	0.00*	1.95±0.53	1.48±0.67
Paired t-test P (Inter-group)	0.210	0.098			0.016*	0.949

\*Significance of relationship at  $P<0.05$ **Table 2: Comparison of Sulcus Bleeding Index at base line and 2 weeks between 2 groups**

Groups	Baseline Mean±SD	2 Weeks Mean±SD	Mean difference	Independent t-test P (Intra-group)
Group A Round ended bristle (REB)	1.66±0.61	1.16±0.51	0.50	0.864
Group B Thinner tip bristle (TTB)	1.91±0.74	1.80±0.82	0.11	0.453
Paired t test P (Inter-group)	0.151	0.001*		

\*Significance of relationship at  $P<0.05$ **Table 3: Comparison of differences of mean differences of plaque and gingival indices from baseline to 2 weeks among 2 groups**

Difference from baseline to 2 weeks	Index	Mean±SD	Mean difference	P
(REB)	Plaque Index	0.48±0.38	0.07	0.485
(TTB)		0.41±0.49		
(REB)	Sulcus Bleeding Index	0.50±0.46	0.39	0.006*
(TTB)		0.11±0.55		

\*Significance of relationship at  $P<0.05$ **Table 4: Comparison of Plaque Indexes in combination with crossover readings using two different types of brushes**

P.I of rounded ended bristle of 60 subject Mean±SD	P.I of thinner tip bristles of 60 subjects	P
1.55±0.57	1.71±0.52	0.126

Paired t test, \*Significance of relationship at  $P<0.05$ 

of significance., with group A showing more reduction in gingival scores as compared to group B [Tables 1-4].

The findings were found to be insignificant. There was insignificant reduction in plaque levels after 42 days between two groups at 6 weeks when, after the crossover, scores obtained with each of brush were compared.

## Discussion

The present study was designed to test and compare the plaque removal efficiency of the two differently designed toothbrushes. Altogether, 60 subjects participated in the study. Following the inclusion criteria and to eliminate any bias, they were randomly divided into two groups, each having 30 participants. PI and GI were recorded at baseline. The insignificant difference in these clinical parameters at base line justifies the comparable

formation of groups and elimination of bias. Each one, in either group, was provided the specified brush. No other change in their oral hygiene practice was done. Following the material and methodology, the study was continued and completed in 6 weeks. After two weeks, PI and GI were recorded again. Neither any history regarding oral hygiene practices was taken from any of the participants nor was any instruction given to them. There was reduction in both the groups. In group A, PI decreased from  $2.79 \pm 0.58$  to  $2.31 \pm 0.44$ , with a mean difference of 0.48. In group B, this decrease was from  $2.95 \pm 0.42$  to  $2.54 \pm 0.60$ , with difference of 0.41 with a marginally (0.07) better reduction in subjects using round ended bristles. Hence, this reduction could be because of introduction of new brushes, though, statistically no significant differences could be observed in the values of PI at two weeks ( $P = 0.098$ ), in between the two groups. This was further substantiated, when the values of PI were compared within the groups, significant reductions in PI could be appreciated ( $P = 0.00$ ). This is attributed to the incorporation of new brushes that was an effective tool for plaque reduction. This is supported by a lot of other studies comparing the effectiveness of the design of the tooth brush bristles in reduction of plaque index.<sup>[3-5]</sup> However, Hawthorne effect cannot be ruled out, but this would have affected both the groups. Similarly, decrease in gingival index in Group A was from  $1.66 \pm 0.61$  to  $1.16 \pm 0.51$ , with a mean difference of 0.50, whereas in Group B this was from  $1.91 \pm 0.74$  to  $1.80 \pm 0.82$ , with mean difference of 0.11. This reflects clearly a better reduction in GI in Group A, and this was statistically significant also at 2 weeks in Group A. It was also observed in a study conducted by Versteeg *et al.*<sup>[4]</sup> However, Dorfer *et al.* found thinner tip bristles more effective in reducing plaque and gingival scores.<sup>[6]</sup> When differences of mean differences from baseline to 2 weeks were compared for PI and GI between the two groups A and B, no statistically significant difference was observed in PI with the mean difference of 0.07 and statistically highly significant difference was observed with

a mean difference of  $-0.39$  in GI. Two weeks later, scaling was performed to make the plaque score zero and subjects were asked to continue with the same brush for further 2 weeks. After 4 weeks (from baseline) when PI was recorded, the mean value was  $1.63 \pm 0.46$  and  $1.95 \pm 0.53$  for group A and group B, respectively. On statistical analyses a highly significant difference was observed between the groups. Two weeks later, at the 6<sup>th</sup> week of study, the mean values of PI were  $1.47 \pm 0.38$  for group A in which subjects switched over to thinner tip bristles from round ended bristles; and  $1.48 \pm 0.67$  for group B in which the subjects switched over to round ended bristles from previous thinner tip bristles. PI values were almost similar and on statistical analyses also no significant difference was observed between the groups. So, the PI scores of subjects using one type of brush before and after cross over were combined and statistically analyzed with similar combination of scores of another type of brush. The mean values of PI were  $1.55 \pm 0.57$  for round ended bristles and  $1.71 \pm 0.52$  for thinner tip bristles. This reflects a better efficiency of round ended bristles in plaque control than thinner tip bristles. The randomized crossover studies reduce bias associated with imbalance in known and unknown confounding variables; they represent the “gold standard” for evaluating therapeutic effectiveness. Unlike the parallel group trial, crossover trials provide each participant with two or more sequential treatments in a random order usually separated by a washout period. Between the groups, round ended bristles were found to be more efficient in plaque control, and the efficacy was statistically significant at 4<sup>th</sup> week ( $P = 0.01$ ). At 6<sup>th</sup> week, after crossover, the results were insignificant. Caporossi *et al.* involved a randomized, single blind, crossover model ( $n = 39$ ) with a split mouth design. They observed round ended bristles removed significantly more plaque than tapered bristles.<sup>[7]</sup> In consistent to present study Versteeg *et al.* also found similar results with end-rounded bristles i.e. it was more effective in reducing plaque and gingival bleeding when compared to those with tapered bristles.<sup>[4]</sup> On the contrary, Dorfer *et al.*<sup>[6]</sup> compared the clinical efficacy of brushes with tapered and round ended bristles and found that brushes with tapered bristles removed more plaque i.e.  $47.4 \pm 18.0\%$ ; when compared to those with rounded end bristles whose plaque score reduction was  $44.1 \pm 15.6\%$ . In present study plaque score reduction was more in round ended bristle than thinner tip bristle toothbrush. Caporossi *et al.*<sup>[7]</sup> conducted a study to compare the incidence of gingival abrasion and the degree of plaque removal obtained after the use of toothbrushes with tapered or end-rounded bristles in the presence or absence of an abrasive dentifrice. End-rounded bristles removed significantly more plaque than tapered bristles, regardless of the use of a dentifrice and concluded that endrounded bristles remove more plaque effectively without causing a higher incidence of gingival abrasion when compared with tapered bristles. So, present study is consistent with the above study. Cassiano *et al.*<sup>[8]</sup> compared the efficacy in supra gingival plaque removal of two soft-bristle toothbrushes and divided the subjects in two groups using either of the toothbrush i.e., thinner tip bristle or round-ended bristles. They found that at baseline pre-brushing whole-mouth, inter proximal, and

gum line plaque scores did not differ between the two groups. Bergenholtz *et al.*,<sup>[9]</sup> conducted a similar study comparing the toothbrush having v-shaped bristles with a round-ended bristle toothbrush. They found no significant difference between the toothbrushes in reducing plaque score. Staudt *et al.*<sup>[10]</sup> compared three toothbrushes namely convex bristle, multilevel bristle, and round-ended bristles. They also found no significant differences between the toothbrushes in overall plaque reduction. Danser *et al.*<sup>[11]</sup> evaluated two types of end-rounding and found that both were effective in plaque control with no difference on the level of plaque removal. Thus, the round-ended bristles have been found to be effective in plaque control. The results of the present study are in accordance to Rustogi *et al.*,<sup>[12]</sup> Sharma *et al.*,<sup>[13]</sup> and Singh *et al.*<sup>[14]</sup> who employed Navy index to quantify the plaque. They compared five toothbrushes having round-ended bristles, multi-level straight bristles with three advanced crisscross bristles, and found that advanced crisscross bristles were superior among them in plaque reduction.<sup>[15]</sup>

## Conclusion

Within the limitations of the study, the data derived from the study show that both the toothbrushes had shown decrease in plaque scores. Round-ended bristles were more efficient, though the differences in between the two groups were not able to reach the level of significance.

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Nil.

## Conflict of interest

There is no conflict of interest.

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