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Effectuality Of Different Designs Of Tooth Brushes In Oral Biofilm Removal

Dr. Prakriti Bhardwaj
BDS, Chandra Dental College & Hospital, Barabanki, U.P., India

***Corresponding Author:**
Dr. Prakriti Bhardwaj
BDS, Chandra Dental College & Hospital, Barabanki, U.P., India

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Abstract

Introduction

This study aimed to analyze the plaque removal efficacy of toothbrushes with different designs. To ascertain the most methodical mechanical mean for maintenance of daily oral hygiene.

toothbrushes are the OTC products available in the market , and no special guidelines are provided to the patient about the usage . so the aim of this particular study is to evaluate the amount of plaque removal on various number of subjects with the use of different designs of tooth brushes with changed orientation of bristles as foundation of oral health is oral prophylaxis.

Dental plaque is defines as soft deposit that form a biofilm adhering to the tooth surfaces present in th e oral cavity .this directly leads to the ladder of periodontal and gingival diseases. This leads to reduction of the pH level at enamel surface causing dissolution of hydroxyapaptite crystals progressing to caries.

Materials And Methods:

An interventional kind of study was planned which involved 30 volunteers falling in the age group of 19to 25 years. 4 different kinds of brushes were chosen to be evaluated for the study and were stated with different codes of interest to the patient. Gilmore-Glickman Modification of Hein Plaque Index was chosen, for the quantitative (Percentage reduction) assessment of plaque.

Results:

Toothbrush with flat design showed a total reduction of 57%. For toothbrush with concave design the data changed from 112.67 to 47.63 with a reduction of 57.67%. Toothbrush with Zigzag bristle designed depicted a Post-brushing mean plaque with score 54.07 compared to 117.57 (mean pre-brushing score) prevailing rise to a reduction of 54.01% . the post-brushing plaque score of 75.00, compared to 109.46 (pre- brushing mean plaque score) with a total reduction of the value 31.48% was calculated with crisscross bristle designed. This draws that all the four toothbrushes have shown to reduce the plaque, somehow to a greater or lesser extent. The reduction was even found to be statistically significant as the p-values were less than 0.05.

Keywords: Plaque; Manual tooth brush, plaque disclosing agent, Erythrosine-PA

Introduction

Plaque is a community of microorganisms that appear as a thin, soft, translucent and tenaciously adherent layer on the unshedding surfaces of oral cavity. This community harbors usually bacteria that are mostly involved in the disease process of dental or periodontal tissues or even both in the oral cavity[1]. Plaque is hence required to be removed to prevent the disease process and to maintain the oral hygiene. [2]

Various methods have been used for plaque removal since long. Mechanical way of removing plaque is the most ancient method and is still proving to be the most effective[2, 3,4] of all .To prevent plaque accumulation, disruption of this complex structural and functional entity is required

and this job can easily and effectively performed by toothbrushes.

Daily use of manual toothbrush is the most effective and fungible way of achieving oral health in most of the population.[2, 4] Toothbrushes have undergone many changes in their basic structure since they were first appreciated by Chinese in the late 16th century. Many modifications have been made to the size, shape, bristle arrangement, texture and stiffness, head design, angulations between head, shaft and handle and other features. A wide variety of toothbrushes is available now- a-days in the market leading to creation of a dilemma in the consumer's mind with respect to efficacy of each toothbrush. Moreover, parameters such as cost, availability, advertising claims, family tradition or personal habits define which toothbrush is going to be used by a particular person. [2]

Several studies have been performed to check and compare the efficacy of different manual toothbrushes especially with reference to the arrangement of bristles but still contradictory results have been observed. Some authors have reached the conclusion that no toothbrush is superior to the other and user is by far the most significant variable in determining efficacy[5, 6, 7, 8] whereas studies and clinical trials performed by others, document superiority of some specific toothbrushes. [3, 9, 10, 11]

Considering the importance of plaque removal and a state of confusion for the selection of toothbrush, present study was undertaken. The objective of present study was to evaluate the efficacy of four different designs of manual toothbrushes available in the market, with respect to plaque removal efficacy.

Materials And Methods:

It was an invivotype of study .Clinical trials were carried out on subjects reporting to department of Periodontology, Chandra dental college and Hospital Barabanki ;(U.P). It was an interventional kind of study . 30 volunteers with equal number of males and females: from the same age group (19 to 25years) participated. A written informed consent got signed from all the volunteers as per the the rules of medical bioethics issued from the Institutional Ethical Review Committee. Volunteers were chosen who were falling in the exclusion and inclusion criteria .

Inclusion criteria:

Volunteers had a full dentition.

Teeth were in normal healthy condition.

There was no crowding, no fixed or removable prosthesis in their mouth.

They had normal periodontium.

Exclusion criteria:

Those having partially erupted wisdom teeth.

Those with pathological periodontal pockets.

Those with cervical, lingual or buccal restorations.

Those with open bite and incompetent lips.

All volunteers were briefed about the study well in advance. Four brushes were selected to be evaluated and compared for efficacy and were given codes that were revealed at the end of the study. The brushes used were as follows:

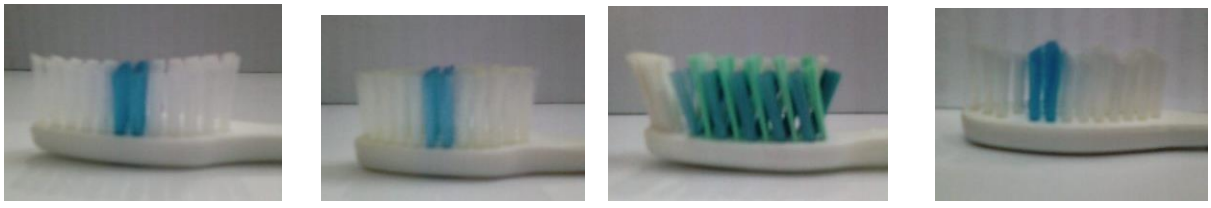
A: Flat bristle designed toothbrush

B: Concave bristle designed toothbrush

C: Crisscross bristle designed toothbrush

D: Zigzag bristle designed toothbrush

Brush-A **Brush-B** **Brush-C** **Brush-D**



Selected brushes were of medium softness. Volunteers were strictly asked to refrain from all kinds of oral hygiene practices for 24 hours before trial with no restriction to eating habits . The study comprised of four

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stages for each volunteer. One stage with three cycles. In each cycle pre and post brushing plaque scores of the volunteer were noted. Plaque was disclosed by using erythrosine-PA England.

Volunteer was asked to chew the tablet and swish it for at least 30 seconds. Extra stain was rinsed off by plain water rinses. The Gilmore-Glickman modification of the Quigley- Hein plaque index was used to assess the plaque score with unaided eye and help of dental mirrors and was recorded on the designed proforma. The mentioned plaque index was used because of its simplicity and reliability in the results.12 Volunteer was then provided with the specific toothbrush for that stage by the examiner who was blind to the study protocol. The volunteer used his/her own technique of brushing for his/her own length of time but the two parameters were observed and noted. No dentifrice was added to the toothbrush. Three cycles were performed for each clinical trial with a washout period of at least 24 hours. Same protocol was followed for all the 30 participants.

PLAQUE SCORING CRITERIA:

0: No plaque

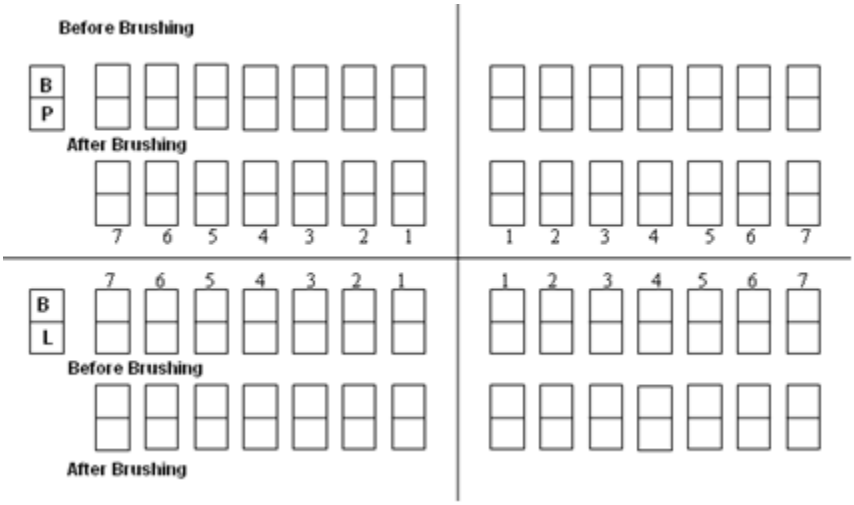
1: Isolated flecks of plaque at the gingival margin

2: A continuous band of plaque up to 1mm at the gingival margin

3: Plaque greater than 1mm in width and covering up to one third of the tooth surface 4: Plaque covering from one thirds to two thirds of the tooth surface

5: Plaque covering more than two thirds of the tooth surface

Name: Age: Gender: Type of toothbrush employed: Brush Code:



Plaque Index:

Plaque index of individual= sum of score of each tooth

Total number of teeth examined

B
P

B
L

B= Buccal

P= Palatal

B= Buccal

L= Lingual

All the data was entered and analyzed using computer program SPSS-20.0. Descriptive statistics

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were applied to calculate mean and standard deviation. Student t-test (To observe statistical significance) was applied to compare pre and post brushing in upper as well as lower teeth. P-value equal to or less than 0.05 was considered significant.

Results:

Results obtained from a sample size of 30 containing equal number of male and female participants were self explanatory. A reduction in post-brushing plaque scores was observed for all the four toothbrushes. P-values have manifested that plaque reduction was statistically significant i.e. p-values were less than 0.05. Results can be tabulated as follows

Table-1: Plaque Removal by Flat Bristle Toothbrush

	N	Pre Brushing	Post Brushing	Reduction	Percentage reduction
Mean	30	113.27	48.70	64.57	57.00%
Range	30	31-169	7-101	N.A	Significant at p<0.05

Difference between pre and post brushing plaque is statistically significant p<0.05

Table-2: Plaque Removal by Concave Bristle Toothbrush

	N	Pre Brushing	Post Brushing	Reduction	Percentage reduction
Mean	30	112.07	47.63	64.63	57.67%
Range	30	44-172	9-93	N.A	Significant at p<0.05

Table-3: Plaque Removal by Crisscross Bristle Toothbrush

	N	Pre Brushing	Post Brushing	Reduction	Percentage reduction
Mean	30	109.46	75.00	34.46	31.48%
Range	30	71-156	4-102	N.A	Significant at p<0.05

Table-4: Plaque Removal by Zigzag Bristle Toothbrush

	N	Pre Brushing	Post Brushing	Reduction	Percentage reduction
Mean	30	117.57	54.07	63.50	54.01%
Range	30	67-148	21-99	N.A	Significant at p<0.05

Table No: 5 Comparison of Plaque Removal by Different Toothbrush

Bristle design	Plaque before brushing	Plaque after brushing	Percentage reduction
Flat	113.27	48.70	57.00%

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Concave	112.07	47.63	57.67%
Crisscross	109.46	55.00	31.48%
Zigzag	117.57	54.07	54.01%

Flat-bristle designed toothbrush the mean plaque score has come to 48.70 (post- brushing) from a pre-brushing mean score of 113.27. It showed a total reduction of 64.57. For Concave-bristle designed toothbrush, the value changed from 112.67 to 47.63 with a reduction of 65.04. Zigzag bristle designed toothbrush showed a Post-brushing mean plaque score of 54.07 compared to 117.57 (mean pre-brushing score) giving rise to a reduction of 63.50. Whereas crisscross bristle designed tooth brush showed a post-brushing plaque score of 75.00, compared to 109.46 (pre-brushing mean plaque score) with a total reduction of the value 34.46. This suggests that all the four toothbrushes have shown plaque reduction, somehow to a greater or lesser extent. The reduction was also found to be statistically significant as the p-values were less than 0.05.

Discussion:

Tooth brushing with fluoridated dentrifices is effective in the reduction of caries, reduction of gingivitis . regular tooth brushing is considered an excellent preventive measure of oral plaque control. As the market of toothbrush designs is flourishing day by day claiming for better effectivenss for removal of plaque . the study was planned for evaluating whether the claimed punchlines prove out with the results or just for the sake of brand adverstisement .

For this purpose, four toothbrushes with different bristle designs were selected. Pre- brushing and post-brushing plaque scores were noted for whole dentition except for 3rd molars.

e.g. crowding, presence of removable or fixed prosthesis, open bite and incompetent lips were also excluded because they give rise to poor oral hygiene and hence greater plaque accumulation which again could make an unnecessary false positive increase in plaque scores.

increased periodontal pocket depths , patients were outlined prior because poor periodontium status could pose problems. As gingival enlargement can mask up the cervical areas buccally and this could have led to false negative plaque scores.

Volunteers with Cervical, buccal or lingual restoration were excluded because these were the surfaces noted for plaque scores and restorations, no matter how smooth they look,they differ at microroughness from normal dental tissue and hence lead to greater possibilities for plaque accumulation[2].

For the quantitative assessment of plaque, Gilmore-Glickman Modification of Hein Plaque Index was selected. The mentioned plaque index score both on the facial and lingual surfaces of whole dentition. Whereas the full mouth scores revealed better values to be compared with the results.

To give emphasis on the selected variable i.e. toothbrush bristle design, all other parameters were kept constant e.g. toothbrush bristle texture (medium softness) and brand. In addition, volunteers used their own methods for brushing.

While comparing the pre-brushing and post- brushing mean plaque scores from tables 1-4, it can be noted that, for Flat-bristle designed toothbrush the mean plaque score turned out to be 48.70 (post-brushing) from a pre brushing mean score of 113.27. It showed a total reduction of 64.57. For Concave-bristle designed toothbrush, the value turned out to be 112.67 to 47.63 with a reduction of 65.04. Zigzag bristle designed toothbrush stated a Postbrushing mean plaque score of 54.07 compared to 117.57 (mean pre-brushing score) giving rise to a reduction of 63.50. Whereas criss-cross bristle designed toothbrush showed a post-brushing plaque score of 75.00, compared to 109.46 (pre- brushing mean plaque score) with a total reduction of the value 34.46. This exclaims that all the four toothbrushes have shown plaque reduction, somehow to a greater or lesser extent. The reduction was also found to be statistically significant as the p-values were less than 0.05. This goes in consistence with most of the studies performed previously[5, 6, 7, 8, 13]. However it is seems evident that the difference between pre and

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post-brushing plaque scores for crisscross bristle designed toothbrush was less as compared to the rest of the three patterns.

Comparing percentage reduction for the four toothbrushes from table-5 reveals that Flat bristle designed and Concave bristle designed toothbrushes showed maximum plaque reduction. Minimum plaque reduction was observed for Criss-cross bristle designed toothbrush than Flat and Concave bristle type, yet it was greater than the Criss-cross one.

Less percentage reduction was seen for Criss-cross type and a greater percentage reduction for Flat and Concave bristle type toothbrushes .For example, most of the population is habitual for using flat bristle designed toothbrushes. More the bizarre structure, the strict is the protocol to be followed and hence more it will be cumbersome for a common man to use it.

Another reason that can be correlated is the angulated bristles of the Criss-cross type of brush. For the rest of three toothbrushes, though as seen from above, surface of the toothbrush head varied, the angulation of single bristle tuft with the base of head was at right angle .these bristles provided a stroke that was perpendicular to the tooth surface and hence delivered maximum force. But for Criss-cross type, optimum force couldn't be applied due to an angle that was less than 90^{o} to the tooth surface. Moreover, a toothbrush with bristles, arranged at a right angle to the base are easy to be adapted to one's own technique of brushing rather than those that are already angulated. In addition, it can be noted, that criss-cross design might be more helpful in removing plaque from approximal surfaces but not the buccal and lingual ones.

The results obtained were statistically significant and reliable because of the involvement of cross over type of single use study design[14].

Conclusion:

The study performed showed that though the industry of tooth brush designs is touching sky but there no such design as such that can predominantly rule out and clean all the plaque to a more efficient level.

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