International Journal of Dental
Research & Development (IJDRD)
ISSN (P): 2250-2386; ISSN (E): 2321-0117
Vol. 6, Issue 2, Jun 2016, 19-28

TRANS STELLAR
•Journal Publications •Research Consultancy

EFFICACY OF TOOTHBRUSHES WITH AND WITHOUT DENTAL FLOSS: A COMPARATIVE STUDY

ARUP KUMAR RABHA[1] & *Dr. SWARGA JYOTI DAS[2]

[1]*Assistant Professor, Department of Dentistry, Tezpur Medical College and Hospital, Tezpur, Assam,India*

[2]*Professor, Department of Periodontics, Regional Dental College, Guwahati, Assam, India*

ABSTRACT

Tooth brushing is considered as 'gold standard' in prevention and control of periodontal diseases. Removal of dental plaque by brushing is achieved primarily through the direct contact between the filaments and surfaces of teeth. Many devices, namely powered toothbrush, water pick, dental floss are developed in order to improve the oral hygiene. Many studies claim that powered toothbrush is superior to the manual toothbrush but some studies showed reverse of it. Considering this, a study of 3 months duration was carried out to compare the efficiency of powered and manual toothbrush with and without dental floss in terms of reduction in plaque and sulcular bleeding indices (n=80) . The subjects were divided into four groups, comprising of 20 in each: Group I = powered toothbrush, Group II = manual toothbrush, Group III = manual toothbrush with dental floss, Group IV = powered toothbrush with dental floss. Plaque and modified sulcular bleeding indices were considered as clinical parameters and recorded at baseline (day 0) and day 30, 60 and 90 using UNC-15 periodontal probe. The observation showed both the powered and manual toothbrushes reduce plaque and bleeding on probing significantly and efficiency is enhanced with the use of dental floss.

KEY WORDS: Bacterial Plaque, Manual Toothbrush, Powered Toothbrush, Dental Floss, Modified Sulcular Bleeding Index

Received: Apr 27, 2016; **Accepted:** May 17, 2016; **Published:** May 24, 2016; **Paper Id.:** IJDRDJUN20163

Original Article

INTRODUCTION

Bacterial plaque is the primary etiologic factor of gingivitis, thus regular removal of dentogingival plaque is crucial for maintenance of periodontal health as well as for primary prevention of gingivitis and periodontitis (Grave *et al.*, 1989).

A natural self-cleansing mechanism exists in the oral cavity. Tongue movement makes contact with the lingual aspect of the posterior and anterior teeth and to a lesser extent, their facial surfaces. The cheek covers the buccal aspects of the posterior maxillary teeth and thereby may help in prevention of the abundant built-up of dental plaque on these surfaces. Salivary flow has some limited potential to clean debris from the interproximal spaces and occlusal pits and is effective, though lesser extent in removing and washing off of the plaque (Cancro and Fischman, 1995). Frictional forces created by the mastication prevent the accumulation of plaque and food debris and assist in removal of the plaque from the occlusal and incisal surfaces of teeth, though these forces are less effective interproximally and at the gingival margin. The natural cleansing of the human dentition by the anatomical structures and masticatory force is limited to the regions less 'at risk' (incisal and occlusal areas) for periodontal disease. This underlies the concept that the only way to prevent and control the periodontal disease is to removal of its causative factor, bacterial plaque (Loe, 1970). The widespread and active means of removal of

plaque at home is tooth brushing using a toothbrush. Thus, a toothbrush is the principal mechanical measure of plaque removal. They are of manual and powered type. The efficiency of both manual and powered toothbrushes relies primarily on the mechanical contact between the bristles and the tooth surfaces. In addition to this, hydrodynamic shear forces created by the bristles of powered brushes provide cleansing activity slightly away from bristle tips. The first powered toothbrush was designed in 1939 (Newman *et al*., 2007).

The toothbrush does not reach the proximal surfaces and interproximal areas as efficiently as it does on the facial, lingual and occlusal aspects. Thus, a number of interdental cleaning devices, namely dental floss, woodsticks, interdental brushes, electrically powered cleaning aids are developed. Selection of an appropriate interdental plaque control measure to supplement the toothbrushing is the key to attain the maximum oral health (Lang *et al*., 1977; Huguson and Koch, 1979). Flossing is the most universally applicable method as it can be used effectively in nearly all clinical situations. A number of studies have suggested that toothbrush along with the floss removes more plaque from the proximal surfaces than by the toothbrush alone without producing unfavorable consequences (Waerhaug, 1981; Kinane *et al.*, 1992).

There is not even a single oral hygiene practice that is applicable for all subjects. The ideal brushing technique is the one that allows complete plaque removal within the least possible time with no damage to the tissues. Based on the position and motion of the toothbrush, the methods of toothbrushing are of horizontal, vertical, circular, sulcular, vibratory and roll technique. The efficacy of powered and manual toothbrushes has been evaluated in a large number of well designed short and long term clinical studies and came out with contradictory observations (Silicia *et al*., 2002; Walsh *et al.*, 2005). Considering this, the present piece of work was carried out to compare the efficacy of powered toothbrush with manual toothbrush with and without dental floss on plaque removal ability and in prevention of gingivitis in terms of the clinical parameters like bleeding on probing and plaque index.

MATERIALS AND METHODS

This study was carried out in the Department of Periodontics, Regional Dental College and Hospital, Guwahati to compare the efficacy of toothbrushes with and without dental floss. A total of 80 subjects participated in the study. The subjects comprises of 24 males and 56 females, with the mean age of 25.41 ± 5.84, (range being 18 to 50). They were randomly categorized into four groups (I, II, III and IV), comprising of 20 in each according to the manner of oral hygiene measures allotted:

- **Group I:** Powered toothbrush (Oral-B *CROSSACTION* Power)
- **Group II:** Manual toothbrush (ORAL-B *CROSSACTION* PRO-HEALTH)
- **Group III:** Manual toothbrush with dental floss
- **Group IV:** Powered toothbrush with dental floss

Clinical Parameters

The following clinical parameters were recorded at baseline (day 0), day 30, 60 and 90 using UNC-15 periodontal probe:

- Plaque index
- Modified sulcular bleeding index

During the pre-test period (before baseline), thorough oral prophylaxis and motivation were imparted to all the subjects participated. They were instructed to brush twice daily in the morning and at night after food for 2 minutes by previously used toothbrush and dentifrices available at home and to rinse with 0.12% chlorhexidine mouthwash twice daily after 30 minutes of brushing. This procedure was found to be effective in reducing the plaque and gingivitis and enabled them to enter to the experimental phase with possible healthiest gingival health. Second appointment was scheduled on day 15, which is considered as baseline or day 0. The specific oral hygiene measures were prescribed to the subjects on day 0.

Plaque Index

Plaque scoring was done at four sites of a tooth, i.e. distofacial, facial, mesiofacial and lingual surface, on the selected teeth (12, 16, 24, 32, 36 and 44) using disclosing agent (AGENT- P) (ICPA Health Products Ltd. Mumbai, India) to visualize the plaque. It was assessed according to the criteria given by Silness and Loe (1964):

- **Score 0:** No plaque in the gingival area.
- **Score 1:** A film of plaque adhering to the free gingival margin and adjacent area of the tooth. The plaque may be seen in situ only after application of disclosing solution or by using the probe on the tooth surface.
- **Score 2:** Moderate accumulation of soft deposits within the gingival pocket and on the gingival margin and/or adjacent tooth surface that can be seen by the naked eye.
- **Score 3:** Abundance of soft matter within the gingival pocket and/or on the gingival margin and adjacent tooth surface

Plaque score of a tooth was obtained by adding four values per tooth and dividing it by four. Scores of each tooth are then added and divided by the total number of teeth examined to give plaque scores for the individual. The oral health status is rated as excellent, good, fair and poor according to the scores obtained:

Score 0:	Excellent
Score 0.1 - 0.9:	Good
Score 1.0 - 1.9:	Fair
Score 2.0 - 3.0:	Poor

Modified Sulcular Bleeding Index

Periodontal probe (UNC-15 probe) was used and passed along the gingival margin to provoke bleeding and absence or presence of bleeding within 30 seconds of probing was scored according to the criteria forwarded by Mombelli *et al.*, (1987):

- **Score 0:** No bleeding.
- **Score 1:** Isolated bleeding points visible
- **Score 2:** Blood forms a confluent red line on margin.
- **Score 3:** Heavy or profuse bleeding.

RESULTS AND OBSERVATIONS

The study was carried out to evaluate the efficacy of powered toothbrush and manual toothbrush when used with and without dental floss in terms of plaque and sulcular bleeding indices.

Plaque Index

The mean plaque score was 1.05 ± 0.43 (range being 0.21- 2.21) on day 0 in group I (Table 1). It was found to be reduced to 0.54 ± 0.39 (ranges from 0.17 to 2.00) and 0.58 ± 0.22 (ranges from 0.17 to 1.04) on day 30 and 60, respectively, which was raised to 0.82 ± 0.33 (ranges from 0.25 to 1.42) on day 90. Thus, the plaque score was found to be reduced by 0.51 and 0.47 on day 30 an 60, respectively, in comparison to day 0, which are statistically very highly significant ($p < 0.001$). Though the plaque score was observed to be reduced by 0.23 on day 90 in comparison to day 0, this difference was not significant statistically ($p > 0.05$), shown in Table 2.

Table 1: Mean ± SEM of Plaque Score at different Time Points (Range of Plaque Score is shown in Bracket)

Group	Day			
	0	30	60	90
I (n=20)	1.05 ± 0.43 (0.21-2.21)	0.54 ± 0.39 (0.17-2.00)	0.58±0.22 (0.17-1.04)	0.82 ± 0.33 (0.25-1.42)
II (n=20)	0.91 ± 0.41 (0.25-1.96)	0.44 ± 0.17 (0.12-0.67)	0.47 ± 0.29 (0.05-1.17)	0.80 ± 0.25 (0.50-1.25)
III (n=20)	1.26 ± 0.45 (0.42-2.04)	0.52 ± 0.30 (0.04-1.04)	0.48 ± 0.29 (0.04-0.87)	0.77 ± 0.30 (0.42-1.75)
IV (n=20)	1.19 ± 0.39 (0.50-1.96)	0.41 ± 0.22 (0.04-0.83)	0.40 ± 0.50 (0.01-1.17)	0.85 ± 0.50 (0.33-2.75)

Table 2: Differences in Mean Plaque Score at different Time Points

Group	Day					
	0 *vs* 30	0 *vs* 60	0 *vs* 90	30 *vs* 60	30 *vs* 90	60 *vs* 90
I (n=20)	0.51***	0.47***	0.23^{ns}	-0.04^{ns}	-0.28*	-0.24**
II (n=20)	0.47***	0.44***	0.11^{ns}	-0.03^{ns}	-0.36***	-0.33***
III (n=20)	0.74***	0.78***	0.49***	0.04^{ns}	-0.25*	-0.29**
IV (n=20)	0.78***	0.79***	0.34*	0.01^{ns}	-0.44**	-0.45**
IV (n=20)	0.78***	0.79***	0.34*	0.01^{ns}	-0.44**	-0.45**

*significant, $p < 0.05$; **highly significant, $p < 0.01$; ***very highly significant, $p < 0.001$; ^{ns} = not significant

As shown in Table 1, the mean plaque score was 0.91 ± 0.41 (range being 0.25- 1.96) on day 0 in group II. It was found to be reduced to 0.44 ± 0.17 (ranges from 0.12 - 0.67) and 0.47 ± 0.29 (ranges from 0.05 to 1.17) on day 30 and 60, respectively. Similarly in group I, elevation of plaque score was found on day 90 i.e. 0.80 ± 0.25 (ranges from 0.50 to 1.25). Thus, the plaque score was found to be reduced by 0.47 and 0.44 on day 30 and 60, respectively in comparison to day 0. These differences were found to be statistically very highly significant ($p < 0.001$). Though statistically not significant, the plaque score was observed to be reduced by 0.11 on day 90 in comparison to day 0 ($p > 0.05$). The plaque score was found to be increased by 0.03 and 0.36 on day 60 and 90, respectively in comparison to day 30. The difference

in plaque score on day 60 was not significant statistically ($p > 0.05$), while the difference on day 90 was very highly significant ($p < 0.001$). Again, plaque score was found to be significantly increased on day 90 when compared with the day 60 ($p < 0.001$).

In group III, the mean plaque score was 1.26 ± 0.45 (range being 0.42- 2.04) on day 0 as shown in Table 1. It was reduced to 0.52 ± 0.30 (ranges from 0.04 to 1.04) and 0.48 ± 0.29 (ranges from 0.04 to 0.87) on day 30 and 60, respectively. Again, elevation of plaque score was found on day 90 i.e. 0.77 ± 0.30 (ranges from 0.42 to 1.75) in comparison to day 30 and 60, as seen in group I and II. Thus, it is seen that the plaque score was reduced by 0.74, 0.78 and 0.49 on day 30, 60 and 90, respectively, in comparison to day 0. The differences on all the days were found to be statistically very highly significant ($p < 0.001$). The plaque score was found to be decreased by 0.04 on day 60 in comparison to day 30, though it was found to be statistically not significant ($p > 0.05$). On the other hand, plaque score was found to be increased by 0.25 on day 90 in comparison to day 30, which was statistically significant. Plaque score was also found to be significantly increased by 0.29 on day 90 when compared with the day 60 ($p < 0.01$).

The mean plaque score was 1.19 ± 0.39 (range being 0.50- 1.96) on day 0 in group IV (Table 1). It was found to be reduced to 0.41 ± 0.22 (ranges from 0.04 to 0.83) and 0.40 ± 0.50 (ranges from 0.01 to 1.17) on day 30 and 60, respectively. Slight elevation of plaque score was found on day 90 i.e. 0.85 ± 0.50 (ranges from 0.33 to 2.75). As shown in Table 2, the plaque score was found to be reduced by 0.78 and 0.79 on day 30 and 60, respectively in comparison to day 0. These differences were found to be statistically very highly significant ($p < 0.001$). Again, when compared the plaque score on day 90 and 0, it was observed that it is reduced by 0.34. This difference was found to be statistically significant ($p < 0.05$). The plaque score was found to decreased on day 60 in comparison to day 30 ($p > 0.05$), though not significant statistically. The plaque score was found to be significantly increased on day 90 in comparison to day 30 and 60.

The changes in mean plaque scores of all the 4 groups at different time points are depicted in Figure 1.

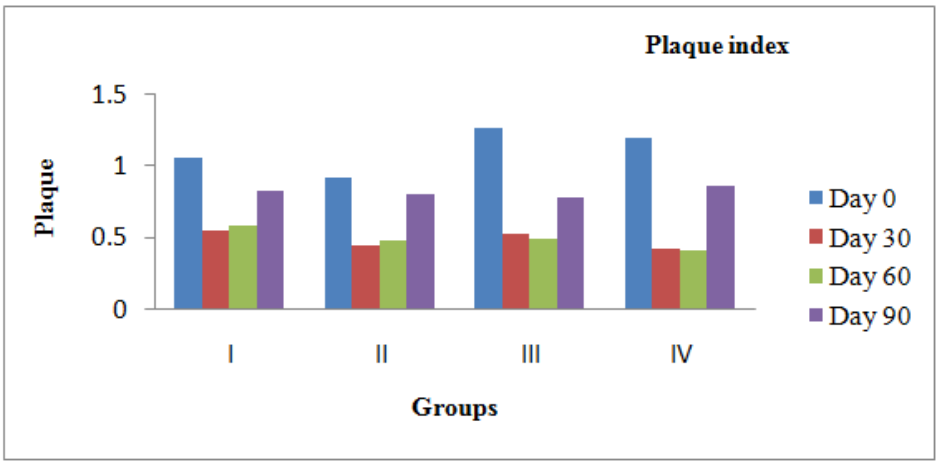

Figure 1: Mean Plaque Score of Various Groups at Various Time Points. Note the Reduction in Plaque Scores in all 4 Groups on Day 30 and 60 followed by Increase in all Groups on Day 90

As shown in Table 3, in group I with use of powered toothbrush, the percentage of reduction in plaque score from the baseline was 48.97, 44.95 and 22.22 on day 30, 60 and 90, respectively. When powered toothbrush was used along with the floss (group IV), the reduction in plaque score was raised to 65.86, 66.05 and 28.51 percent on day 30, 60 and 90, respectively. Similarly, the percentage of reduction in plaque score was 51.96, 48.46 and 12.28 on day 30, 60 and 90, respectively in group II with the use of manual toothbrush. In group III, the percentage of reduction in the plaque score was

58.28, 61.96 and 38.82 percents on day 30, 60 and 90, respectively in comparison to the baseline.

Table 3: Percentages (%) of Reduction in Plaque from Baseline

Day	Group			
	I	II	III	IV
30	48.97	51.96	58.28	65.86
60	44.95	48.46	61.96	66.05
90	22.22	12.28	38.82	28.51

In summary, no difference was observed in plaque removal ability of the manual and powered toothbrush (group I *vs* II). However, plaque removal efficiency was found to be more with the combined use of dental floss irrespective of the type of toothbrush (group III and IV), though not significant statistically at all the time points of observations. Again, no difference in plaque removal ability was seen with combined use of dental floss along with the brushes (group III *vs* IV).

Modified Sulcular Bleeding (MSB) Index

The mean modified sulcular bleeding (MSB) score was 0.41 ± 0.35 (range being 0.00 - 1.05) on day 0 in group I (Table 4). It was found to be reduced to 0.18 ± 0.23 (ranges from 0.00 to 0.77) and 0.14 ± 0.13 (ranges from 0.00 to 0.50) on day 30 and 60, respectively, which was raised to 0.18 ± 0.11 (ranges from 0.00 to 0.37) on day 90. Thus, the MSB score was found to be reduced by 0.23, 0.27 and 0.23 on day 30, 60 and 90 in comparison to day 0, which are statistically significant ($p < 0.05$) (Table 5). However, there is no prominent difference in MSB score at other time points of observations.

The mean MSB score was 0.33 ± 0.26 (range being 0.00 - 1.05) on day 0 in group II (Table 4). It was found to be reduced to 0.12 ± 0.20 (ranges from 0.00 to 0.77) and 0.13 ± 0.16 (ranges from 0.00 to 0.62) on day 30 and 60, respectively, which was raised to 0.20 ± 0.11 (ranges from 0.00 to 0.43) on day 90. As shown in Table 5, the MSB score was found to be significantly reduced by 0.21 and 0.20 on day 30 and 60 in comparison to day 0 ($p < 0.05$). Though the MSB score was reduced by 0.13 on day 90 in comparison to day 0, this difference is not statistically significant ($p > 0.05$). Again, there is no prominent difference in MSB score at other time points of observations.

Table 4: Mean ± SEM of MSB Score at different Time Points (Range of MSB Score is shown in Bracket)

Group	Day			
	0	30	60	90
I (n=20)	0.41 ± 0.35 (0.00-1.05)	0.18 ± 0.23 (0.00-0.77)	0.14 ± 0.13 (0.00-0.50)	0.18 ± 0.11 (0.00-0.37)
II (n=20)	0.33 ± 0.26 (0.00-1.05)	0.12 ± 0.20 (0.00-0.77)	0.13 ± 0.16 (0.00-0.62)	0.20 ± 0.11 (0.00 - 0.43)
III (n=20)	0.53 ± 0.28 (0.02-1.02)	0.20 ± 0.18 (0.00-0.52)	0.10 ± 0.11 (0.00-0.39)	0.18 ± 0.17 (0.00-0.66)
IV (n=20)	0.43 ± 0.27 (0.05-1.11)	0.14 ± 0.12 (0.00-0.34)	0.17 ± 0.16 (0.00-0.45)	0.24 ± 0.15 (0.04-0.66)

Table 5: Differences in Mean MSB Score at different Time Points

Group	Day					
	0 *vs* 30	0 *vs* 60	0 *vs* 90	30 *vs* 60	30 *vs* 90	60 *vs* 90
I (n=20)	0.23*	0.27**	0.23*	0.04^{ns}	0.00^{ns}	-0.04^{ns}
II (n=20)	0.21*	0.20*	0.13^{ns}	-0.01^{ns}	-0.08^{ns}	-0.07^{ns}

Table 5: contd.,						
III (n=20)	0.33**	0.43**	0.35**	0.10^{ns}	0.02^{ns}	-0.08^{ns}
III (n=20)	0.29**	0.26**	0.19**	-0.03^{ns}	-0.10*	-0.07^{ns}

*Significant ($p < 0.05$); **Highly significant ($p < 0.01$); ^{ns} = not significant ($p > 0.05$)

As shown in Table 4, the mean MSB score was 0.53 ± 0.28 (range being 0.02- 1.02) on day 0 in group III. The mean MSB was recorded as 0.20 ± 0.18 (ranges from 0.00 to 0.52) and 0.10 ± 0.11 (ranges from 0.00 to 0.39) on day 30 and 60, respectively, which was then raised to 0.18 ± 0.17 (ranges from 0.00 to 0.66) on day 90. Thus, the MSB score was found to be reduced by 0.33, 0.43 and 0.35 on day 30, 60 and 90, respectively, in comparison to day 0, which were found to be statistically highly significant ($p < 0.01$), as shown in Table 5. The differences observed in MSB score at other time points of observations were not significant statistically.

The mean MSB score was 0.43 ± 0.27 (range being 0.05-1.11) on day 0 in group IV (Table 4). It was found to be reduced to 0.14 ± 0.12 (ranges from 0.00 to 0.34) and 0.17 ± 0.16 (ranges from 0.00 to 0.45) on day 30 and 60, respectively, which was then raised to 0.24 ± 0.15 (ranges from 0.04 to 0.66) on day 90. As shown in Table 5, the MSB score was found to be reduced by 0.29, 0.26 and 0.19 on day 30, 60 and 90 in comparison to day 0. All these differences were statistically highly significant ($p < 0.01$). The differences observed in MSB score at other time points of observations were not significant statistically.

As shown in Table 6, in group I with use of powered toothbrush, the percentage of reduction in MSB score from the baseline was 55.25, 65.46 and 55.18 on day 30, 60 and 90, respectively. When powered toothbrush was used along with the floss (group IV), the percentage of reduction in MSB score was found to be 66.53, 59.30 and 43.73 percent on day 30, 60 and 90, respectively. Similarly, the percentage of reduction in MSB score was 61.78, 58.79 and 37.54 on day 30, 60 and 90, respectively in group II with the use of manual toothbrush. The subjects who have used floss along with the manual toothbrush (group III), the reduction in MSB score was recorded as 63.22, 80.29 and 65.89 percents on day 30, 60 and 90, respectively in comparison to the baseline.

In summary, the mean MSB score was reduced on day 30 in all four groups in comparison to day 0. MSB score was reduced at all the time points of records regardless the type of brush used (group I *vs* II), though not significant statistically. Again, MSB score was found to be reduced significantly with combined use of manual toothbrush and dental floss than the use of manual toothbrush alone (group II *vs* III). However, no difference in reduction in MSB score was seen with combined use of powered toothbrush and dental floss than that of the powered toothbrush alone (group I *vs* IV).

Table 6: Percentages of Reduction in Bleeding Index from Baseline

Days	Group			
	I	II	III	IV
30	55.25	61.78	63.22	66.53
60	65.46	58.79	80.29	59.30
90	55.18	37.54	65.89	43.73

DISCUSSIONS

Relationship between the dental plaque and periodontal diseases is well documented (Loe, 1970). The growth of dental plaque occurs within an hour and reaches its original level within 24 hrs after thorough cleaning (Addy *et al.,* 1992). Regular brushing helps to disintegrate the established plaque (Ciancio, 1995) and meticulous self performed plaque removal measures can modify both the quantity and composition of subgingival plaque (Hellstrom *et al.,* 1996).

A number of studies have been conducted to compare the efficacy of powered toothbrush with manual toothbrush (Vesteeg *et al*., 2006). The findings however are contradictory; superiority of powered toothbrush over the manual in removing plaque and controlling gingivitis has been shown by various investigators (Aruna *et al*, 2011). Again, few studies demonstrated equal efficacy of both the manual and powered toothbrush in plaque removal (Sheikh-Al-Eslamian *et al.*, 2014).

Again, since toothbrush does not reach the interproximal areas, it necessitates the application of interdental plaque control measures to supplement the toothbrush (Lang *et al*., 1977). Various studies have demonstrated that flossing along with the toothbrushing (manual/powered) is more efficient in plaque removal and reducing gingival inflammation (Versteeg *et al.*, 2006). This is supported by the observations of this study.

Reduction in mean plaque score was found to be statistically very highly significant ($p < 0.001$) on day 30 in comparison to day 0. However, slight elevation of plaque score was noted on day 60 in comparison to day 30 in group I and II, in contrast of reduction in group III and IV. On the other hand, the mean plaque level was found to be raised on day 90 in all the groups. However, it is well noted that mean plaque level is at much lower level up to the day 90 in comparison to the baseline. This could be partly due the fact of effectiveness of the new brushes and partly due to enthusiasm for oral care and use of new devices from the subject point of view. On the other hand, increase in mean plaque score was recorded in all the groups on day 90 in comparison to day 30 and 60. This may be related to the lowering efficiency of both the manual and powered toothbrushes with age of the toothbrush.

The mean modified sulcular bleeding (MSB) score was found to be reduced in all the groups on day 30 in comparison to day 0. The MSB values were found to be reduced in group I and III, while this is increased in group II and IV on day 60 in comparison to day 30. On day 90, this value was found to be increased in all the groups in comparison to the day 60. However, it is notable that MSB value is at much lower level up to the day 90 in comparison to the baseline.

No differences in MSB values were noted between the manual and powered toothbrushes (group I *vs.* II). The findings of the study thus support the findings of various investigators who have shown the equal efficiency of powered and manual toothbrushes in terms of plaque reduction and control of gingival inflammation (Ainamo *et al*., 1997; Ass and Gjermo, 2000; Versteeg *et al*., 2006). The observations of the present study revealed that reduction in plaque and modified sulcular bleeding indices occur with the use of both manual and powered toothbrushes with or without dental floss.

CONCLUSIONS

Within limits of this clinical study, we may conclude that both the powered and manual toothbrushes reduce plaque significantly and this efficiency is further enhanced with the use of dental floss along with the toothbrushes. Both the powered and manual toothbrushes reduce bleeding on probing significantly and this is further enhanced with the use of dental floss along with the toothbrushes.

REFERENCES

1. *Aass, A. M. and Gjermo, P. (2000). Comparison of oral hygiene efficacy of one manual and two electric oothbrushes. Acta Odontol Scand: 58 (4): 166-170.*
2. *Ainamo, J., Xie, Q., Ainamo, A. & Kallio, P. (1997). Assessment of the effect of an oscillating/ rotating electric toothbrush on oral health. A 12-month longitudinal study. J Clin Periodontol., 24, 28- 33.*
3. *Addy, M., Slayne, M. A. & Wade, W. G. (1992). The formation and control of dental plaque: an overview. Journal of Applied Bacteriology: 73: 289- 278.*
4. *Aruna, K., Rosaiah, K. & Muktishree, M., (2011), Comparative evaluation of clinical efficacy of manual and powered tooth brush. Indian J Stomatol., 2, 233-37.*
5. *Cancro, L. P. & Fischman, S. L. (1995). The expected effect on oral health of dental plaque control through mechanical removal. Perio. 2000:8:60-76.*
6. *Graves, R. C., Disney, J. A., & Stamm, J. W. (1989). Comparative effectiveness of flossing and brushing in reducing interproximal bleeding. J Periodontol, 60, 243-7*
7. *Hellstrom, M. K., Ramberg, P., Krok, L., & Lindhe, J. (1996), The effect of supragingival plaque control on the subgingival microflora in human periodontitis. J Clin Periodontol., 23, 934 – 40.*
8. *Hugoson, A. and Koch, G. (1979). Oral health in 1000 individuals aged 3-70 years in the community of Jonkoping, Sweden. Swedish dental Journal, 3, 69-87.*
9. *Kinane, D. F., Jenkins, W. M. & Paterson, A. J. (1992). Comparative efficacy of the standard flossing procedure and a new floss applicator in reducing interproximal bleeding: a short-term study. J Periodontol., 63, 757-60.*
10. *Lang, N. P., Cuummings, B. R. & Loe, H. A. (1977). Oral hygiene and gingival health in Danish dental students and faculty. Community Dentistry and Oral epidemiology, 5, 237 – 242.*
11. *Loe, H. (1970): A review of the prevention and control of plaque. In: McHugh WD, editor. Dental plaque. Edinburg and London: E and S Livingstone, 259 – 270.*
12. *Lindhe, J., Weijden, F., Echeverria, J. J. & Sanz, M. (2008). Mechanical Supragingival plaque control. Clinical Periodontology and Implant Dentistry. (5th ed.)*
13. *Newman, M. G., Takei, H. H., Klokkevold, P. R., & Carranza, F. A (2007). Carranza's Clinical Periodontology (10th ed.). Philadelphia, PA: Saunders.*
14. *Sicilia, A., Arregui, L., Gallego, M., Cabezas, B. & Cuesta S (2002): A systematic review of powered vs manual toothbrushes in periodontal cause-related therapy. J Clin periodontol; 29 (suppl) 3, 39-54.*
15. *Silness, J. & Loe, H. (1964), Periodontal disease in pregnancy. Correlation between oral hygiene and periodontal condition. Acta Odontol Scand, 22, 121-35.*
16. *Sharma, N., Galustians, H. J., Qaqish, J. G., Rustogi, K. N., Petrone, M. E. & Volpe, A. R. (2000). Comparative efficacy on supragingival plaque and gingivitis of a manual toothbrush (Colgate plus) and a battery - powered toothbrush (Colgate Actibrush) over a 30-days period. Compend contin Edu Dent Suppl., 31, 9 -13.*
17. *Sheikh-Al-Eslamian, S. M., Youssefi, N., Monir, S. E. S. & Kadkhodazadeh, M. (2014). Comparison of manual and electric toothbrush in dental plaque removal: a clinical trial; J Dent Res., 6, 21046.*
18. *Soben Peter (2008). Essentials of Preventive and Community Dentistry (4th ed.). Arya (Medi) Publishing House.*

19. *Vandana, K. & Penumatsa, G. S., (2004), A comparative evaluation of an ultrasonic and a manual toothbrush on the oral hygiene status and stain removing efficacy". Journal of Indian Society of Pedodontics and Preventive Dentistry, 22, 33-35.*

20. *Versteeg, P. A., Timmerman, M. F., Paraskevas, S. & van derWeijden, G. A. (2006). Evaluation of several brushing motion combinations in relation to plaque – removing efficacy with Oral - B CrossAction power: a professional brushing study. Int J Dent Hyg, 4, 204-8.*

21. *Walsh, M., Heckman, B., Leggott, P., Armitage, G. & Robertson, P. B. (1989). Comparison of manual and power tooth brushing, with and without adjunctive oral irrigation, for controlling plaque and gingivitis. J Clin Periodontol., 16, 419 – 427.*

22. *Waerhaug, J. (1981). Effect of toothbrushing on subgingival plaque formation. J Periodontol, 52, 30 - 34.*