

A COMPARATIVE EVALUATION OF POWERED VS MANUAL TOOTHBRUSHES – A CLINICAL STUDY

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ABSTRACT

In the present clinical case control study, changes in the preexisting gingival index, plaque index and gingival bleeding index was compared using a powered toothbrush versus manual toothbrush. 150 dental students participated manual toothbrush while Group II using powered toothbrush. Each participant was instructed to practice daily oral hygiene procedure using modified bass method with the assigned toothbrush. Clinical parameters were recorded at baseline, 1, 3 and 6 months and the data was subjected to “t-test” & “p-test” using SPSS (version 15.0) software. At baseline, mean plaque index and gingival bleeding index of group II were slightly higher as compared to that of Group-I yet the difference between two groups was statistically insignificant ($p > 0.05$). 1st and 3rd month follow-up did not present significant difference in the clinical parameters. At 6th month follow-up, mean value for all the parameters was found to be lower in cases as

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compared to controls and the difference was statistically significant for gingival index and gingival bleeding index ($p > 0.05$).

KEYWORDS: Toothbrush, Manual, Powered, Ultra soft Toothbrush.

INTRODUCTION

Prevention has become a pivotal step in the modern dental practice and effective plaque control has become a basic step in the practice of preventive dentistry. Good oral hygiene (the removal of plaque) by effective tooth brushing has a key role in oral health.

Dental plaque is the primary cause of gingivitis and is implicated in the progression to Periodontitis although the link between the two is complex and not well understood.^[1] Intraoral cleaning devices have been a part of human civilization since long and a strong correlation exists between the severity of gingivitis and periodontitis and the accumulation of dental plaque.^[2]

Toothbrushes are the most widely used oral hygiene aids. It is the principal instrument in general use for accomplishing the goals of plaque control. Over the years, the popularity of toothbrush use has increased not only in urban but also in rural areas too.

There are basically three types of tooth brushes: manual toothbrushes, powered and sonic toothbrushes. There are different types of manual toothbrushes available. Earlier they were distinguished by the nature and type of bristles used. For most of the previous century, manual toothbrush designs have had flat bristle trim patterns and rectangular heads that had bristles made up of natural fiber or animal hair.^[3] It was in 1938, that nylon fibers emerged as a new source of bristles for use in toothbrushes.

Powered brushes simulate the manual motion of toothbrushes with lateral and rotary movements of the brush head. More recently, there has been a progression towards rotary action brushes.^[4] Brushes which operate at a higher frequency of vibration have also been introduced.^[5,6]

As the powered toothbrush is so popular the common question raised is about the efficacy of the powered or manual toothbrushes. A number of studies to answer this question have been carried out but there is divided opinion among the researchers. The results are quite confusing and the studies often contradict with each other and mainly focus on the type of toothbrush,

tooth cleaning method, dexterity of use which varies from individual to individual.^[7,8,9,10,11] Several meta analyses and Cochrane reviews have shown the powered toothbrushes to have slightly higher efficacy in terms of plaque reduction and gingivitis control.^[12,13,14,15,16]

The powered toothbrushes are currently marketed aggressively in Indian market and in wake of no concrete conclusive evidence showing their supremacy, it is the right time to carry out a study to compare the efficacy of manual tooth brush vis-à-vis powered tooth brush using a common protocol of use.

MATERIALS AND METHODS

The present study was carried out in the Department of Periodontology, Sardar Patel Post Graduate Institute of Dental & Medical Sciences, Lucknow (U.P.), India with an aim to compare the efficacy of powered tooth brushing versus manual tooth brushing using a common protocol of use. For this purpose A Case-control full mouth, single-blind examiner study with subjects using manual toothbrushes were designated as controls and those using powered toothbrushes were designated as cases for a period of six months. A total of 150 subjects (volunteers from amongst undergraduate dental students of our institute) with fully developed teeth having good general and oral health, those who had not received any periodontal therapy for past 3 months, willing to attend the hospital at recall intervals were enrolled in the study while those with poor manual dexterity, taking drugs that could affect the state of the gingival tissue including corticosteroids and non-steroidal anti-inflammatory drugs, those using orthodontic appliances, having muco-gingival problems, having multiple carious teeth and poor oral hygiene, those using any other supplemental plaque control devices like interdental cleansing aids or mouthwashes and those with the habit of taking alcohol, smoking or chewing tobacco were excluded from the study.

After being enrolled in the study, the subjects were randomly divided into two groups, using random draw of lots. A total of 75 subjects were advised to use manual toothbrush for the purpose of maintenance of oral hygiene and comprised the control group of the study while remaining 75 subjects were advised to use powered toothbrush for the purpose of maintenance of oral hygiene.

Group – 1(Control) Manual Toothbrush: All the patients participating in the study were provided Colgate Sensitive Ultra Soft toothbrush (Fig.1) for maintenance of oral hygiene.

Toothbrushes were replaced at every 2 months or whenever complained for damage of bristles.

Group – II (Case) - Powered Toothbrush: All the subjects were provided Colgate Motion™ Soft Powered Toothbrush (Fig. 2) with a set of rechargeable batteries. Toothbrush heads were replaced at every 2 months or whenever complained of damage of bristles/loss of function.

Procedure

All the subjects falling in the sampling frame and fulfilling the inclusion criteria were invited to participate in the study. Only those providing informed consent and willing to report as per schedule of the study were enrolled as the subjects in the study. At recruitment a thorough oral examination was carried out and clinical parameters (gingival index, plaque index and gingival bleeding index) were recorded. Instructions and pamphlets regarding the method of brushing technique, handling and manipulation of both the brushes was given with a commercially available fluoridated dentifrice (Pepsodent Regular™). The subjects were asked to refrain from all oral hygiene procedures for 24 hours prior to every recall visit.

Brushing Technique

Modified Bass Brushing technique was demonstrated to all the participants.^[17]

Follow Up

All the subjects in both the groups were followed up at 1, 3 and 6 months intervals for evaluation of clinical parameters.

Outcome Measures

The outcome was measured in terms of change in gingival index, plaque index and gingival bleeding index.

DATA ANALYSIS

The data was analyzed using Statistical Package for Social Sciences version 15.0. Although all the three parameters were ordinal in nature, however, they had been used as a mean value and have been treated as continuous variables, hence a parametric evaluation plan was adopted after ascertaining the normality of distributions. Independent samples “t” test was used to compare the data. A “p” value less than 0.05 indicated a statistically significant association.

RESULTS

At baseline, mean plaque index and gingival bleeding index of Group II were slightly higher as compared to that of Group I whereas mean gingival index of Group I was slightly higher than that of Group II yet the difference between two groups was not significant statistically ($p>0.05$). No significant difference between two groups was observed for any of the clinical parameters at 1 and 3 months follow up intervals. At six months mean value for all the parameters was found to be lower in cases as compared to controls and the difference was significant statistically too for gingival index and gingival bleeding index ($p<0.05$) (Table 1).

With respect to change, between baseline to 1 month, a marginal decrease in plaque index was observed in both the groups which continued to increase further with time. In both the groups maximum reduction was observed between baseline to 6 months. Except for change between baseline to six months, at none of the time intervals the difference in magnitude of change between two groups was significant statistically. For gingival index too, a marginal decrease was observed in both the groups which continued to increase and reached at peak at 6 months. In both the groups maximum and statistically significant reduction was observed between baseline to 6 months. For gingival bleeding index too, Between baseline to 1 month, a marginal decrease in gingival bleeding index was observed in both the groups. Subsequently a continuous reduction in gingival bleeding index was observed in both the groups. In both the groups maximum reduction was observed between baseline to 6 months (Table 2).

Table 1: Comparison of Clinical Parameters at baseline and at different post-intervention follow up intervals

SN	Parameter	Control (n=75)		Cases (n=75)		Difference		Significance of difference	
		Mean	SD	Mean	SD	Mean	SE	"t"	"p"
Baseline									
1.	Plaque index	1.53	0.84	1.66	0.79	-0.138	0.133	-1.038	0.301
2.	Gingival index	1.42	0.84	1.40	0.93	0.020	0.145	0.135	0.892
3.	Gingival bleeding index	36.26	6.91	38.47	7.02	-2.201	1.137	-1.935	0.055
One month									
1.	Plaque index	1.47	0.88	1.65	0.87	-0.181	0.143	-1.266	0.208
2.	Gingival index	1.38	0.85	1.35	0.95	0.032	0.147	0.217	0.829
3.	Gingival bleeding index	35.34	8.23	36.71	8.14	-1.370	1.337	-1.025	0.307
3 months									
1.	Plaque index	1.37	0.74	1.53	0.76	-0.164	0.122	-1.342	0.182

2.	Gingival index	1.30	0.81	1.30	0.87	0.004	0.138	0.026	0.979
3.	Gingival bleeding index	33.01	7.32	35.51	8.51	-2.505	1.296	-1.933	0.055
6 months									
1.	Plaque index	1.26	0.69	1.16	0.50	0.093	0.098	0.942	0.348
2.	Gingival index	1.21	0.83	0.96	0.58	0.252	0.117	2.148	0.033
3.	Gingival bleeding index	30.41	8.22	26.95	10.04	3.461	1.498	2.310	0.022

Table 2: Comparison of Change in different clinical parameters (from baseline) between two groups at different time intervals

SN	Parameter	Group I (n=75)		Group II (n=75)		Difference		Significance of difference	
		Mean	SD	Mean	SD	Mean	SE	"t"	"p"
Plaque Index									
1.	Between baseline to 1 month	-0.055	0.238	-0.012	0.255	-0.043	0.04	1.068	0.294
2.	Between baseline to 3 months	-0.155	0.207	-0.130	0.205	-0.025	0.03	0.744	0.463
3.	Between baseline to 6 months	-0.270	0.310	-0.501	0.530	0.231	0.07	3.258	0.003
Gingival Index									
1.	Between baseline to 1 month	-0.035	0.227	-0.048	0.257	0.01	0.04	0.328	0.745
2.	Between baseline to 3 months	-0.114	0.210	-0.098	0.219	-0.02	0.03	0.457	0.651
3.	Between baseline to 6 months	-0.204	0.389	-0.436	0.491	0.23	0.07	3.208	0.003
Gingival bleeding index									
1.	Between baseline to 1 month	-0.925	4.756	-1.756	6.144	0.83	0.90	0.926	0.362
2.	Between baseline to 3 months	-3.255	3.452	-2.951	4.696	-0.30	0.67	0.452	0.655
3.	Between baseline to 6 months	-5.857	6.803	-11.52	8.637	5.66	1.27	4.461	<0.001



Fig. 1



Fig. 2

DISCUSSION

In present study, at baseline mean plaque, gingival and gingival bleeding (%) indices of subjects using manual toothbrush was 1.53 ± 0.84 , 1.42 ± 0.84 and 36.26 ± 6.91 respectively whereas the same in subjects using powered toothbrush was 1.66 ± 0.79 , 1.40 ± 0.93 and 38.47 ± 7.02 respectively, thus showing no significant differences between two groups. These indices showed a mild effect on periodontal health of the subjects. Most of the studies carried out among college going students even among dental students have reported similar oral health indices before any intervention.^[27,28] The mild impairment of oral health in this group of subjects is often associated with improper oral hygiene owing to academic pressure, diet based on carbohydrate-rich diet and consumption of highly processed food products, neglect of prophylaxis and dental check-up.^[20]

Follow up was carried out at 1-month, 3-months and 6-months interval respectively. At first follow up at 1-month mean plaque, gingival and gingival bleeding (%) indices of subjects using manual toothbrush was 1.47 ± 0.88 , 1.38 ± 0.85 and 35.34 ± 8.23 respectively whereas the same in subjects using powered toothbrush was 1.65 ± 0.87 , 1.35 ± 0.95 and 36.71 ± 8.14 respectively. Once again showing no significant difference between two groups. It was observed that a marginal decrease in plaque index, gingival index and gingival bleeding index was observed (0.055 ± 0.238 ; 0.035 ± 0.227 and 0.925 ± 4.756 respectively) in Group I. A similar trend of decrease in plaque index, gingival index and gingival bleeding index was observed in Group II too (0.012 ± 0.255 , 0.048 ± 0.257 and 1.756 ± 6.144 respectively). Statistically, there was no significant difference in mean reduction in three parameters between two groups. The marginal changes in three parameters in both the groups indicated that brushing alone irrespective of the type of tooth brush used is insufficient to bring about a qualitative significant change in oral health parameters during a short period of 1-month. In a study by Yousaf *et al.* (2012).^[21] a nominal impact of toothbrushing was observed on oral health indicators irrespective of type of tooth brush (manual vs powered) used. However, in a study by Aruna *et al.* (2011),^[22] a significant impact of tooth brushing (either manual or powered) was observed on the plaque indices from day 7 itself.

However, at 1 month interval, both the groups showed a mild decrease in oral health parameters but certainly did not show a superior efficacy of either of two techniques. A number of studies comparing manual and powered tooth brushes analyzed in a metaanalysis have shown reduction in oral health indicators at both short and long-term.^[23] In present

study, most of the subjects had low plaque and gingival indices, the stationary bi-level bristles in the brush acted more or less like a manual tooth brush as they did not have a movement of their own and their performance was dependent on the manual dexterity of the individual. Thus the design of the powered tooth brush itself required a technical dexterity to master to make its efficient use. Thus, 1-month findings in present study are in accordance with the observations made by Yousaf *et al.* (2012),^[21] and Hickman *et al.* (2003).^[24]

In present study, changes in oral health indicators were visible from 3 months interval in both the groups. At 3 months, mean plaque index, gingival index and gingival bleeding index (%) in Group I was 1.37 ± 0.74 , 1.30 ± 0.81 and 33.01 ± 7.32 respectively as compared to 1.53 ± 0.76 , 1.30 ± 0.87 and 35.51 ± 8.51 respectively in Group II. However, the difference between two groups was not significant statistically. Contrary to first follow up at one month, the observations at third month follow up revealed a reduction in all the parameters in both the groups. In terms of change in PI, GI and gingival bleeding index, a reduction of 0.155 ± 0.207 , 0.114 ± 0.210 and 3.255 ± 3.452 respectively was observed in manual tooth brush group which was significant statistically as compared to baseline values whereas in powered tooth brush group this reduction was 0.130 ± 0.204 , 0.098 ± 0.219 and 2.951 ± 4.694 respectively. In both the groups there was a significant difference in mean values for all the three parameters as compared to baseline.

The results in the present assessment might be perplexing but can be explained on the basis of the fact that the subjects were undergraduate dental students, who were well aware of the importance of tooth brushing and its technique. Thus, it might be possible that the cleaning efficiency of powered tooth brush owing to its automated regular synchronization and simulation of Bass method might not have an influence on the outcome cannot be ruled out. Keeping this limitation aside, the present study did not find a major short term utility of powered toothbrushes. The powered toothbrushes of course showed a better efficacy in long-term.

CONCLUSION

Toothbrushes are a better choice in long-term use. However, given the limitation of our sample, we would recommend further studies in general population. On the basis of findings in present study, it might be concluded that powered o confirm and substantiate these results.

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