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BATTERY OPERATED AND MANUAL TOOTH BRUSH;

COMPARISON FOR DENTAL PLAQUE REMOVAL

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ABSTRACT… Background: Dental plaque may cause oral problems that may include dental caries, periodontal problems, and halitosis. Motivation, awareness and manual dexterity have much effect on tooth brushing. The advantages related with manual and battery operated tooth brushing have been reported different in the literature. **Objective:** To compare the manual and battery operated tooth brush for plaque removal efficiency. **Study Design:** Randomized control trial. **Setting:** The Dental OPD of Department of Community Dentistry, Liaquat University of Medical and Health Sciences, Jamshoro. **Period:** November 2011 to June 2013. **Methods:** Total 100 patients of both genders, aged ≥18 years were included. Patients were equally divided into manual and battery operated brush groups. The presence of plaque was checked and plaque index was recorded. Wilcoxon sign pair test was applied to compare pre and post plaque score for manual and battery operated tooth brush. Independent sample t test was applied to compare percent reduction of plaque score between groups. The significance level of P-value was up to 0.05. **Results:** In manual brush group, 27 were male and 23 were female. Mean age was 25.65±5.87 years. In battery operated brush group, 32 were male, 18 were female. Mean age was 29.92±10.37 years. Before manual brushing mean plaque score was 1.88±0.65 while after brushing it was reduced to 1.11±0.43. Percent reduction was 40.96%, p=0.0005. Mean plaque score was 1.35±0.37 and 0.69±0.29 before and after brushing respectively in battery operated brushing. Percent reduction was 48.9%, p=0.0005. Battery operated brushing was significantly more effective than manual (p=0.023). **Conclusion:** Battery operated tooth brush was significantly more effective than manual toothbrush. It removes significantly more supragingival plaque than manual tooth brush.

Key words: Manual Brush, Battery Operated Brush, Plaque Index Score

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INTRODUCTION

Dental plaque primarily causes gingivitis, periodontitis, and caries; therefore removing it is considered a pivotal part to maintain oral wellbeing.[1] Bacterial growth is the main cause of periodontal problems. In dental plaque more than 500 bacterial strains can be found.[2] Their evolution has made their survival possible at places like vicinity of tooth surface, gingival epithelium, and oral cavity.

During past few years advanced technology has recognized that the bacterial survival for prolonged duration in sulcus or pocket area highly depends upon the condition when subgingival bacterial biofilm is formed i.e. dental plaque.[3] Each micro colony of the bacterium protects other ones and by a coating of extracellular slime. They develop an extraordinary resistance against human antibodies, local administration of antimicrobials and systematic administration of antibiotics. It would take 1,500 folds increased dose of antibiotics than usual to eliminate these bacterial biofilms, but the human would die by that high dose far before it affect the bacterial bioflm.[3,4] Therefore, we just wipe off their colonies physically and it is the most effective way of controlling them i.e. proper and regular tooth brusing.[3,4]

Various factors are involved in effective tooth brushing like motivation, awareness and manual dexterity. This association of plaque levels with

periodontal disease needs to be well understood yet. There is a significant caries reduction when brushed with fluoride toothpaste.[5] But it is believed that the effect of fluoride mainly reduces caries and not the tooth brushing.[6]

The head of battery operated tooth brush rotates and laterally moves in simulation of manual tooth brushes. A more advanced form of battery operated tooth brushes also vibrate at high frequency.[7,8] The battery powered/electric tooth brushes were commercialized in early 1960s.[9-11]

The goal of this study was to compare manual and powered brushes in relation to the removal of plaque and gingival health. We also assessed the efficiency of the tooth brushing through the plaque index scale.

MATERIAL & METHOD

This study was a randomized control trial which carried out from November 2011 to June 2013. Total 100 patients who were visited Dental OPD of Department of Community Dentistry, Liaquat University of Medical and Health Sciences, Jamshoro were included in the study. The patients were randomly selected and equally divided into two groups (50 in each group):
Group-A: Using manual toothbrush
Group-B: Using battery operated toothbrush.

The selection was made by randomly drawing of envelops. The 50 envelops of Group-A contained the questionnaire, manual toothbrush, tooth paste, plaque disclosing tablet, and plaque index form. The remaining 50 envelopes of Group-B enclosed the questionnaire, battery operated toothbrush, tooth paste, plaque disclosing tablet and plaque index form.

Selected patients were both male and female patients of age 18 years or older. They were first registered and a registration number was assigned to each participant. After getting the registration slip, patients were examined and the medical history was taken. Consent was also taken from each individual after explaining the research procedure and tooth brushing technique was demonstrated on typo-dent of teeth. The patients were advised to chew the disclosing tablets properly after briefing. With the help of dental probe the presence of plaque was checked and the plaque score was recorded in plaque index form. The Group-A advised to brush their teeth manually and then check the plaque and score was recorded in the plaque index form after brushing. Participants of Group-B were advised to brush their teeth with battery operated brush and after brushing they also checked the plaque and score was recorded in plaque index form.

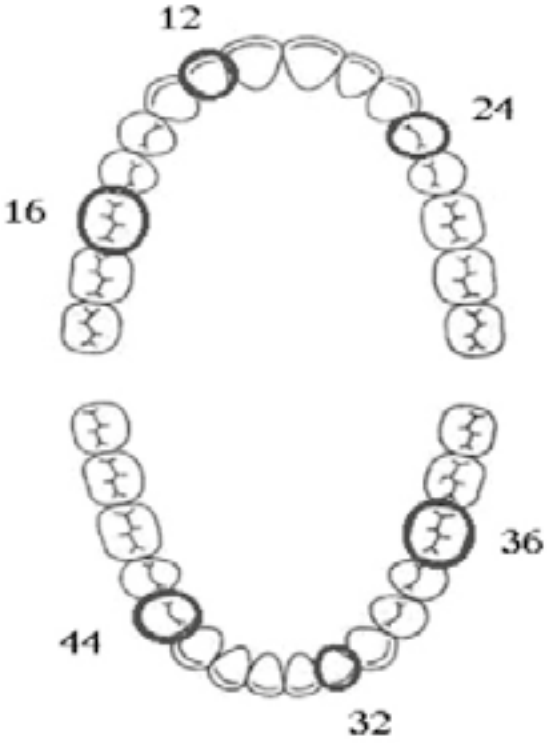
The Plaque Index System

Mineralized deposition and soft debris on teeth are recorded to index the plaque in estimation of oral health in Silness-Loe indexing system. Only present teeth are taken into account. Buccal, lingual, mesial and distal surfaces of every tooth is individually scored 0-3, and after obtaining mean of all scores the following criteria are used for indexing:

Score	Criteria
0	No Plaque
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.
2	Moderate accumulation of soft deposit s within the gingival pocket, or the tooth and gingival margin which can be seen with the naked eye.
3	Abundance of soft matter within the gingival pocket and/or on the tooth and gingival margin.

Data was entered and analyzed using the SPSS Version 21. Descriptive statistics were calculated. Mean, standard deviation, 95% confidence interval, median and IQR were computed for quantitative variables i.e. age and plaque score, for both groups. Frequency and percentage were computed for qualitative variables i.e. age groups and gender, for both groups. Box and wicker plots were used to present median plaque score for each group. Wilcoxon sign rank test was applied to compare pre and post plaque score for man-

ual and battery operated toothbrush while independent sample t test was applied to compare percent reduction of plaque score between two study groups. The significance level of P-value was up to 0.05



RESULTS

Among total 100 patients, mean age was 28.24±8.56 years (95%CI: 26.54 to 29.94) and it was observed that most of the patients (51%) were between 21 to 30 years. Overall there were 59% male and 41% female patients. Further, all patients were equally divided into two groups so, the analysis was also done according to groups and results were presented accordingly. Among patients of Group-A, who were used manual brush to brush their teeth, 27(54%) were male and 23(46%) were female, average age was 25.65±5.87 years. 9(18%) patients were less than or equal to 20 years, 31(62%) aged 21-30 years, and 10(20%) aged 31-40 years, and no patients aged more than 40 years. Among patients of Group-B, who brushed their teeth using battery operated brushes, 32(64%) were male and 18(36%) were female, average age of these patients was 29.92±5.87 years. Age of 10(20%) patients were less than or equal to 20 years, 22(44%) aged 21-30 years, and 9(18%) aged 31-40 years, and 9(18%) patients were aged more than 40 years. Chi square analysis for association of gender and age groups revealed no significant association of gender and age with brushes groups with (p=0.309) and (p=0.052) for gender and age groups respectively (Table-I). Comparison of

	Manual Brushing	Powered Brushing	Total	P-Value
Age Groups (years)	**Mean ± SD N (%)**	**Mean ± SD N (%)**	**Mean ± SD N (%)**	
	25.65 ± 5.87	**29.92±10.37**	**28.24±8.56**	
≤ 20	9(18%)	10(20%)	**19(19%)**	**0.052+**
21 to 30	31(62%)	22(44%)	**53(53%)**	
31 to 40	10(20%)	9(18%)	**19(19%)**	
>40	0(0%)	9(18%)	**9(9%)**	
Gender				
Male	27(54%)	32(64%)	**59(59%)**	**0.309+**
Female	23(46%)	18(36%)	**41(41%)**	

+ Not Significant at 0.05 levels

Table-I. Descriptive statistics of Gender and Age

plaque score before and after brushing in both tooth brush groups was done. The results showed that in Group-A (manual toothbrush), before brushing the mean plaque score was 1.88±0.65 while after brushing the mean plaque score was reduced to 1.11±0.43 (Figure-1). Wilcoxon sign rank test was applied to see the significance of the difference in plaque score among two procedures. The results revealed that the difference is significant (p=0.0005). Similarly in Group-B (battery operated toothbrush), before brushing mean plaque score was 1.35±0.37 while after brushing this mean was reduced to 0.69±0.29 (Figure-2). Wilcoxon sign rank test was also applied to see the significance of the difference in plaque score among two procedures. The results revealed that the difference is significant (p=0.0005) (Table-II).

The percent reduction in plaque score among patients who used manual brush to brush their teeth was 40.96% while among patients who used battery operated brush, the percent reduction in plaque score was 48.9% (Figure-3). Comparison was done by applying independent sample t-test to see the significance reduction and efficacy of the two toothbrushes. The results demonstrated that the reduction in plaque score was significant (p=0.023) and battery operated toothbrush (Group-B) was more effective than the manual toothbrush (Group-A) (Table-III). For all surfaces the battery operated toothbrush was about 8% more effective than the manual toothbrush. Percent deduction of plaque score of patients are presented in Figure-4. Reduction was significantly higher in Group-B that is 51% to more than 70% than Group-A.

	Manual Toothbrush		
	Before	**After**	**P Value**
Mean ± SD	1.88±0.65	1.11±0.43	**0.0005***
95% C I (Lower Limit – Upper Limit)	1.69 – 2.06	0.98 – 1.22	
Median (IQR)	1.75 (1.33)	1.02 (0.86)	
Percent Reduction	40.96%		
	Battery Operated Toothbrush		
	Before	**After**	**P Value**
Mean ± SD	1.35±0.37	0.69±0.29	**0.0005***
95% C I (Lower Limit – Upper Limit)	1.24 – 1.45	0.61 – 0.77	
Median (IQR)	1.29 (0.22)	0.69 (0.28)	
Percent Reduction	48.9%		

* Significant at 0.01 level
Wilcoxon Signed rank test was applied
Percent reduction = (Pre – Post / Pre) * 100

Table-II. Comparison of Pre and Post Plaque Score

	Manual Toothbrush	Battery Operated Toothbrush	P Value
Mean ± SD	40.96±12.5	48.9±20.58	0.023**
95% C I (Lower Limit – Upper Limit)	37.77 – 44.88	43.32 – 55.03	
Median (IQR)	40.0 (12.78)	48.4 (6.59)	
Percent Reduction	7.94%		

*** Significant at 0.05 level*
Independent Sample t-test was applied

Table-III. Comparison of Pre and Post Plaque Score

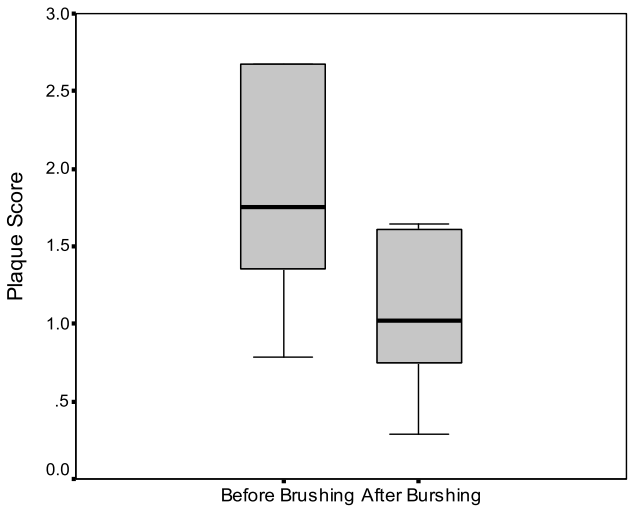
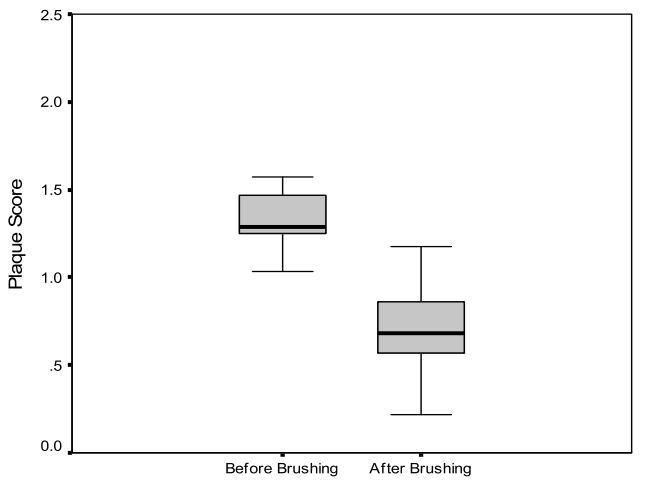
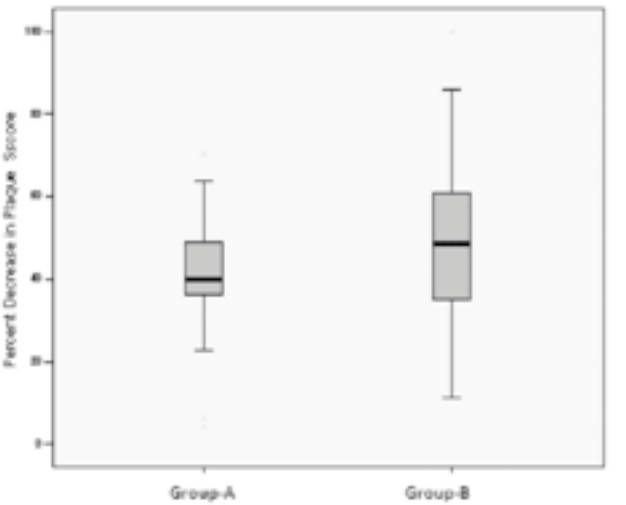


Figure-1: Pre and post comparison of plaque score among patients using manual toothbrush.



Figue-2. Pre and post comparison of plaque score among patients using battery operated toothbrush.

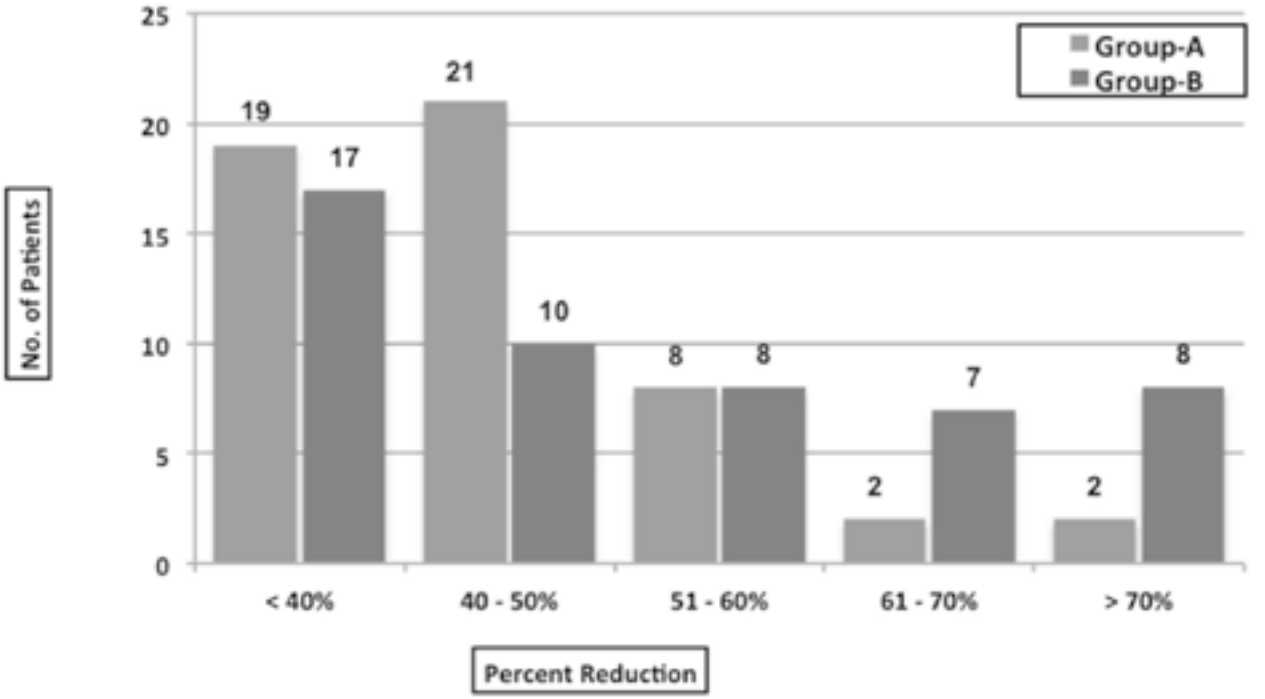


Figue-3. Comparison of percent reduction in plaque study groups

DISCUSSION

The assessment of effectiveness of the two toothbrushes confirmed that the battery operated toothbrush (Group-B) was significantly more effective than the manual toothbrush for all surface ($p<0.05$), it was about 8% more efficient than the manual toothbrush. Reduction was appreciably also higher in Group-B that is 51% to more than 70% than Group-A.

The introduction of electric toothbrushes in the 1960s, paved the way for the dentists to compare their efficiency with the conventional toothbrushes.[12-18]



Figue-4. Frequency of patients according to percent reduction plaque score in study groups

The main advantage of battery operated tooth brush is that it may help to overcome the need for professional training in brushing technique and good manual dexterity. Oral health is of high importance among cases being treated for orthodontic diseases. Their periodontal tissue hygiene is considered of utmost importance in prolonged duration as well as of controversies.[19,20] Bacterial biofilms and food debris are accumulated in presence of bands, brackets, ligature wires and elastics, creating threat to oral health by increasing chances of periodontal disease and caries. To achieve the goal of preventing or minimizing the these problems appropriate and regular use of tooth brush in recommended among various physical methods to clean the teeth surface.[21-26]

Different types of tooth brushes are available in the market with variation for age and person to person requirements. Controversial results are reported in literature regarding more effective cleaning by electric tooth brushes in non-orthodontic patients[27-29] and equally effective results by using either sort of tooth brushes.[30,31] An evaluation of studies reported the effectiveness of battery operated toothbrushes over manual tooth brushes.[32] However, there were at least one limitation in each of the study e.g. controlling, very short duration, absence of randomization, non-blinding.[32,33] Hence, these results cannot be considered without the chance of bias.

Killoy et al conducted a study of short duration and reported that electric and manual toothbrushes reduced the plaque 70% and 65% respectively in cases of periodontitis.[34] In contrast Wilcoxon et al conducted a long duration study and reported that reduction in plaque and gingivitis scores was statistically significant ($p<0.001$) in study group that used electric toothbrush with counter rotations when compared with the study group that used manual toothbrush.[35]

Similar results were reported by a clinical trial of eighteen months duration that found that the score index was highly significant when efficiency of electric toothbrush with counter rotations was compared with manual toothbrush in 40 adolescents being treated for orthodontic

disease.[36] Electric toothbrush with counter rotation is the only type of electric toothbrush that is proved to be significantly efficient by the studies that observe strict parameters.[37] Other types of electric toothbrushes did not show any significant reduction in plaque and gingivitis score when compared with manual toothbrush.

Limitations

The findings of this study are based upon average data presented by the subjects. Different results may be presented by different individuals as per their understanding of brushing process. Hence, some cases may present better results with manual toothbrush while some present better results with electric toothbrush. Some cases even present similar outcome with both types. For the clinician, the Cochrane data means that if a patient is doing poorly with a manual toothbrush, they may perform better with a powered one. Similarly, if a patient is doing well with a manual brush and enquires about using a powered brush, they can be informed that the powered brush should be as effective as the manual one. In all cases, clinical advice must be based on the individual patient's needs.

CONCLUSION

The results showed that both toothbrushes mean difference between pre and post brushing plaque scores decreased. The battery operated toothbrush minimizes both the need for professional instruction with regard to brushing technique and the importance of good manual dexterity. For all surfaces the assessment of effectiveness confirmed that the battery operated tooth brush was significantly more effective than the manual toothbrush.

Therefore, it is concluded that the dental plaque removal in battery operated tooth brushing is higher than manual tooth brushing that removes significantly more supra-gingival plaque.

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"If you want to walk fast walk alone.
If you want to walk far
walk together."

Unknown

AUTHORSHIP AND CONTRIBUTION DECLARATION

Sr. #	Author-s Full Name	Contribution to the paper	Author=s Signature
1	Dr. Munir Ahmed Banglani	Proposal of study, data collection	
2	Dr. M. Feroz Jhangir	Intro writing, Methodology	
3	Dr. Suneel Kumar Punjabi	Editing & Discussion writing, Proof reading	
4	Dr. Naveen Khawaja	Literature searching	
5	Dr. Nida Talpur	Editing & Abstract writing