A clinical comparison of a battery-powered toothbrush and a manual toothbrush in patients with chronic periodontitis

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ABSTRACT

Background: Microbiological plaque is the main etiological factor in the development of periodontal diseases. Regular and effective removal of plaque from all surfaces of the teeth is essential for the prevention of these diseases. The purpose of this study was to compare the plaque removal effectiveness of a battery powered and manual toothbrush by using plaque index and to compare differences in pocket depth and gingival index between the two groups over a 3-months period.

Material and methods: This study was randomized controlled and examine-blind designed. Forty patients were included in the study, all the subjects were non smokers male and they were stratified and randomized to one of the two brushing groups. A total of 5 visits were planned for data recording, the clinical parameters include: - plaque index, gingival index, probing pocket depth.

Results: Significant and highly significant differences was found for both groups during the study according to the t-test in PI and GI, Also significant difference was found between the two groups in favor of manual tooth brush. The longitudinal changes in pocket depth show significant and highly significant difference from the base line in the both groups and using t-test but No statistical difference was detected between the batteries powered brushing and manual brushing groups in the outcome measure of PD at any time point during the study.

Conclusion: According to the results obtained both toothbrushes' mean difference between baseline and post-brushing plaque scores decreased. Manual tooth brush plaque removal was more efficient in comparison to battery powered toothbrush also gingival health shows more improvement with manual tooth brush when compared with battery powered tooth brush; no significant difference in pocket depth was found with both types of tooth brushes.

Keywords: tooth brushing methods. (J Bagh Coll Dentistry 2010;22(4):74-77).

INTRODUCTION

Supragingival plaque removal is an important factor in preventing periodontal diseases and caries. Tooth brushing remains the most reliable method of controlling supragingival bacterial plaque. Utilization of dental floss, mouth rinsing and attending recalls every 3 months regularly are also important steps for oral health care. Different types of toothbrushes, such as battery or electrically powered have been introduced into the market.

Early power toothbrushes, introduced commercially in the 1960's, were often designed based on the conventional manual toothbrush. Movement generally simulated hand-motion, back-and-forth or side-to-side, offering little cleaning advantage over manual toothbrushes. Dental professionals tended to recommend them for 'special care' patients. In contrast, a variety of distinct designs and modes of action are available today. Certain models have been proven to offer significant benefits versus a manual toothbrush in removing plaque biofilm among the general population, and various features have been introduced to increase brushing time and improve cleaning efficiency.

The main advantage of battery powered toothbrushes is that they require no electrical energy.

Battery powered toothbrushes are recommended for children, disabled people and orthodontic patients. Individuals who are in high caries activity risk should also use these rotary toothbrushes.

MATERIALS AND METHODS

This study was randomized, controlled and examine-blind designed. Forty patients were included in the study, all the subjects were non smokers male and they were stratified and randomized to one of the two brushing groups. A total of 5 visits were planned for data recording. The following inclusion and exclusion criteria were applied:

Inclusion criteria
- Aged between 25-60 years;
- A minimum of 20 permanent teeth;
- Periodontal disease identified clinically with probing pocket depth (PPD) of at least 4mm examined clinically;
- A mean full-mouth plaque score of at least 2.0.

Exclusion criteria
- Previous routine use of a powered toothbrush;
- Mental handicap;
- Physical handicap that restricted the free movement of the hands or fingers;
- Receiving oral hygiene instructions from a dental professional within the previous 3 months;

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Acute intra oral lesions. Both groups of patients were supplied with the same readily available standardized fluoride containing toothpaste and toothbrushes for the duration of the study. Toothbrush heads and manual tooth brushes were replaced every month. Additional-interdental aids (floss and interdental brushes) were supplied to each patient.

Periodontal assessments: The periodontal examination were performed on a dental chair, the periodontal variables were recorded on four sites (mesial, buccal, distal and lingual) for all teeth except the third molar which was excluded.

The clinical parameters:-
- Plaque index (Silness and Loe 1964)
- Gingival index (Loe 1967)
- Probing pocket depth (PPD):- Is defined as the distance from the gingival margin to the most apical penetration of the periodontal probe inserted in to the gingival crevice. The sites for measurement were mid-buccal line, mid -palatal line, mesio-buccal and disto- buccal line angle no pressure was used, the probe was allowed to fall by its own weight. (PPD) were estimated by using William probe

RESULTS
Plaque index (PII)

The mean PII scores for all visits are summarized in table 1. The mean &SD full mouth plaque scores recorded at screening were as follows: battery-powered tooth brush (BPTB), 2.27±0.35 and manual tooth brush (MTB), 2.21 ±0.44 at baseline these means were drown during the study for both groups as they reach to 1.33±0.23 & 1.02±0.18 for the battery-powered tooth brush and manual tooth brush respectively. Highly significant reduction in plaque for both groups was seen during the study according to the F-test.

Comparison between the two groups by using t-test found Significant and highly significant difference between the battery powered tooth brush and manual tooth brush in favor of manual tooth brush as shown in table 2

Table 1: Mean and SD of Plaque Index

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<thead>
<tr>
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<tr>
<td>Mean ±SD(BPTB)</td>
<td>2.27±0.35</td>
<td>1.75±0.35</td>
<td>1.60±0.22</td>
<td>1.33±0.23</td>
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<tr>
<td>Mean ±SD(MTB)</td>
<td>2.21±0.44</td>
<td>1.65±0.20</td>
<td>1.38±0.17</td>
<td>1.25±0.18</td>
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<tr>
<td>P-value</td>
<td>PO.001</td>
<td>PO.001</td>
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ANOVA F-test MTB=61.83 p=0.00 P<0.001 High Significant ANOVA F-test BPTB=37.84 P<0.001 High Significant

Table 2: T-test of Plaque Index between batteries powered tooth brush and manual tooth brush

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>t-test</td>
<td>0.431</td>
<td>1.117</td>
<td>3.827</td>
<td>3.212</td>
<td>4.123</td>
</tr>
<tr>
<td>P-value</td>
<td>0.671</td>
<td>0.05</td>
<td>0.001</td>
<td>0.005</td>
<td>0.001</td>
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<tr>
<td>Sig</td>
<td>NS*</td>
<td>§**</td>
<td>HS</td>
<td>s**</td>
<td>HS</td>
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*P>0.05 Non significant **P<0.05 Significant ***P<0.001 High significant

Gingival index (GI)

Table 3 shows the mean GI at baseline, 3, 6, 9 and 12 weeks. The mean GI at baseline were as follows: battery-powered brush, 1.48±0.37 and manual brush, 1.44±0.37. The full mouth gingival scores were reduced at week 3 and become 1.32±0.35 and 1.20±0.38 for battery-powered tooth brush and manual brush respectively. This reduction of GI remained to week 12 and become 0.88±0.18 & 0.74±0.23 for the battery-powered tooth brush and manual tooth brush respectively. The data for GI were assessed by the two-way ANOVA detected highly significant differences (pO.001) in all 4 clinical measures between visits while Comparison between the two groups by using t-test found Significant difference between the battery powered tooth brush and manual tooth brush in favor of manual tooth brush in the 6,9 and 12 week while non significant difference was reported at the third week as shown in table 4

Table 3: Mean and SD of gingival Index

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<tbody>
<tr>
<td>Mean ±SD(BPTB)</td>
<td>1.48±0.37</td>
<td>1.32±0.35</td>
<td>1.16±0.32</td>
<td>1.06±0.30</td>
<td>0.88±0.18</td>
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<tr>
<td>Mean ±SD(MTB)</td>
<td>1.44±0.37</td>
<td>1.20±0.38</td>
<td>1.05±0.36</td>
<td>0.89±0.31</td>
<td>0.74±0.23</td>
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<tr>
<td>P-value</td>
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ANOVA F-test BPTB=10.90 pO.00 PO.001 High Significant ANOVA F-test MTB=12. pO.00 PO.001 High Significant
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Table 4: T-test of gingival Index between batteries powered tooth brush and manual tooth brush

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<tr>
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<tr>
<td>t-test</td>
<td>0.535</td>
<td>1.660</td>
<td>1.353</td>
<td>2.559</td>
<td>2.722</td>
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<td>P-value</td>
<td>0.599</td>
<td>0.113</td>
<td>0.002</td>
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<tr>
<td>Sig</td>
<td>NS</td>
<td>NS</td>
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*P>0.05 Non significant **PO.05 Significant

Pocket depth (PPD)

The longitudinal changes in pocket depth show significant and highly significant difference from the baseline in the both groups by using F-test as shown in the table 5.

No statistical difference was detected between the batteries powered brushing and manual brushing groups in the outcome measure of PPD at any time point during the study as shown in table (6).

Table 5: Mean and SD of Pocket depth

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<tbody>
<tr>
<td>Mean±SD(BPTB)</td>
<td>3.66±0.62</td>
<td>3.49±0.79</td>
<td>3.26±0.56</td>
<td>3.15±0.57</td>
<td>3.05±0.60</td>
</tr>
<tr>
<td>Mean±SD(MTB)</td>
<td>3.54±0.44</td>
<td>3.36±0.44</td>
<td>3.21±0.43</td>
<td>3.07±0.42</td>
<td>2.93±0.41</td>
</tr>
<tr>
<td>P-value</td>
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<td>0.172</td>
<td>PO.001</td>
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</table>

ANOVA F-test BPTB =3.05 p=0.02 PO.05 Significant ANOVA F-test MTB =6.18 p=0.00 PO.001 High Significant

Table 6: T-test between batteries powered brush and manual tooth brush by total

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<tr>
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<tbody>
<tr>
<td>t-test&amp;P-value</td>
<td>0.793</td>
<td>0.636</td>
<td>0.32</td>
<td>0.569</td>
<td>0.884</td>
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<tr>
<td>P-value</td>
<td>0.438</td>
<td>0.532</td>
<td>0.752</td>
<td>0.566</td>
<td>0.388</td>
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<tr>
<td>Sig</td>
<td>NS</td>
<td>NS</td>
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*P>0.05 Non significant

DISCUSSION

The results of the study suggested that battery-powered and conventional manual toothbrushes are effective in obtaining gingival health and good plaque control. Standard fluoridated toothpaste was used to reveal the variations between the different types of toothbrushes.

Significant statistical difference was detected between the battery-powered brushing and manual brushing groups in the primary clinical outcome measure of PII and GI but non significant difference in the secondary outcome measure of PD at any time point during the study.

Many clinical studies have demonstrated that power toothbrushes deliver superior plaque removal compared to manual toothbrushes, leading to growing acceptance in the dental community that power toothbrushes offer superior plaque control relative to manual toothbrushes (5) but results of the present study showed that manual tooth brush plaque removal efficacy was better when compared to battery powered tooth brushing, the patients were educated for the brushing technique and using the battery powered brush. Therefore, the manual tooth brushing group also showed an improvement regarding to plaque removal at the end of the study in comparison to the baseline data. This result was in agreement with Khambay and Walmsley who reported that electric toothbrushes are considered inferior to manual brushing in removing plaque from the interproximal and lingual tooth surfaces (2,5,9) and disagreement with Trombelli et al and Wilcoxon et al they assessed that plaque scores were lower in patients who used the counter rotary power brush rather than a manual brush by evaluating supragingival plaque for orthodontic patients (10).

Effective plaque control leads to additional oral health benefits, including reduced gingivitis and stain. The habit of utilizing toothbrush, dental floss and mouth rinses, and the frequency of dental visits, nutrition and environmental factors are causing individual differences in terms of oral and dental health (3). Manual or battery powered toothbrush recommendation depends on the individual’s oral status. Patients who are mentally handicapped or physically handicapped and those who are undergoing orthodontic treatment may be advised to use battery-powered toothbrushes for a better-controlled brushing procedure.

REFERENCES

3. Cross WG. A comparative study of tooth cleaning using