INTRODUCTION

Dental plaque is defined as soft deposits that form a biofilm adhering to the tooth surface, removable and fixed restorations.\(^1\) It has long been recognized that the presence of dental plaque leads to gingivitis, periodontitis and is also capable of reducing the pH at the surface of enamel to the levels that can cause dissolution of the hydroxyapatite crystals and initiates caries.\(^2\)

Effective plaque control facilitates good gingival and periodontal health, prevents tooth decay and preserves oral health for lifetime.\(^1\) Though there are various methods including chemical and other mechanical methods for plaque removal but tooth brushing is the widely accepted and primary method of removing plaque. In spite of brushing being the most accepted method of plaque removal, still its efficacy depends on the type of brush, method of brushing, ideal time to brush, individual having an effective technique of brushing and time taken to achieve a fast learning curve in effective handling of the toothbrush under supervision.\(^3\)

Tooth brushes now come in wide range of styles and varieties accomplished by complex product descriptions and scientific design theories. Various designs of toothbrushes have been recommended to enhance mechanical removal of dental plaque.\(^4\)

Two types of brushes are widely used, manual and powered toothbrush. The powered toothbrushes appear to be helpful in improving the oral health of physically or mentally handicapped individuals because these devices require minimal hand motion and coordination skills. Some models are designed with each bristle rotating individually and are effective plaque removers.\(^5\) Although previous comparative stud-
ies between powered and manual toothbrushes have led to somewhat equivocal results, however, a review study showed advantage in plaque removal and reduction in gingivitis was seen for oscillating/rotating design of power brush. But no such study was conducted at local level in Pakistan to compare various types of brushes.

This study was conducted on armed forces personnel and their families with an aim of determining the difference in plaque reduction with powered electric brushes and manual brushes.

**METHODOLOGY**

This study was a comparative study, and included 70 patients visiting the OPD of Armed Forces Institute of Dentistry, Rawalpindi, Pakistan from Jan 2010 to July 2011. Patients enrolled in the study were in the age range of 19 and 44 years presenting mild gingivitis on examination. The inclusion criteria included a plaque score ranging from 1-3 of Silness-Löe plaque index, healthy subjects who had the presence of more than 20 natural teeth excluding plaque retentive areas such as grossly carious teeth or orthodontically bonded abutments, absence of major hard and soft tissue oral lesions and maintenance of oral hygiene by brushing the teeth twice daily.

The exclusion criteria were if patient had taken antibiotic or underwent dental prophylaxis one month prior to the inclusion in the study, pregnant and lactating females, those with grossly neglected oral hygiene, who use other plaque removing methods and with any physical abnormality limiting manual dexterity.

Patients were divided into two groups of 35 each. Informed consent was taken from all patients. Group A patients were advised to use electronic powered tooth brushes (Oral-B complete action power deep clean), while group B patients were advised manual brushes (Oral-B cross action pro-health Manual tooth brush). To rule out the effect of toothpaste both group patients were advised to use same tooth paste (Colgate cavity protection toothpaste) during the study period. Technique of tooth brushing with both manual and powered electric brush was demonstrated and checked at follow up visits to rule out the chances of wrong technique. Patients were advised to brush at least 2 minutes. Oral hygiene instruction were given on each visit.

At baseline, after one and 3 months, plaque index was recorded according to Silness-Löe plaque index which is based on recording both soft debris and mineralized deposits on four surfaces (buccal, mesial, distal and lingual) of teeth 16, 12, 24, 36, 32, 44. The scores from four surfaces of the tooth were added and divided by four in order to give plaque index for the tooth. The index of the patient is obtained by summing the indices of all six teeth dividing by six. Data were statistically analyzed using SPSS version 12.

**RESULTS**

Plaque score was evaluated at three occasions at baseline, after 1 month, after 3 months.

At baseline none of the participants in both groups were plaque free (having a score of 0) most of the participants at baseline had plaque score of 1 and 2 (Table 1).

At one month follow up a trend of decrease in plaques score was observed both groups. Most of the participants presented with score of 1. In powered brush group it was observed that at baseline plaque score of 1 in 12(34.3%) where as at one month follow up it was 19(54.3%). In powered brush group plaque score 2 was observed in 19(54.3%) at baseline, which was reduced to 13(37.1%) at one month follow up. Similar trend was observed in the manual brushing group was observed at baseline and one month follow up (Table 2).

At three months follow up it was observed that more patients in powered brushing had no plaque (0 score) or lower plaque score (1 score). At three months follow up there were 6(17.1%) patients with no plaque in powered brushing group compared to 5(14.3%). A plaque score of 1 was observed in 25(71.4%) patients of powered brushing group where as only 22(62.8%) patients of manual brushing group (Table 3).

**TABLE 1: PLAQUE INDEX AT BASE LINE**

<table>
<thead>
<tr>
<th>Score</th>
<th>Powered brushing</th>
<th>Manual brushing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n(%)</td>
<td>n(%)</td>
</tr>
<tr>
<td>0</td>
<td>0(0)</td>
<td>0(0)</td>
</tr>
<tr>
<td>1</td>
<td>12(34.3)</td>
<td>17(48.6)</td>
</tr>
<tr>
<td>2</td>
<td>19(54.3)</td>
<td>15(42.8)</td>
</tr>
<tr>
<td>3</td>
<td>4(11.4)</td>
<td>3(8.6)</td>
</tr>
</tbody>
</table>
Comparison of powered and manual toothbrushes in removal of plaque

removing plaque. Numerous clinical studies have shown a direct relationship between oral hygiene status, the quality of plaque, and the prevalence and severity of periodontal diseases.³

Mechanical plaque control is done by daily cleaning with toothbrush and other oral hygiene aids. Tooth brushing is primary mechanical mean of removing plaque, thereby preventing gingivitis and, to some extent, controlling dental caries.⁶

Various designs of toothbrushes have now been recommended to enhance the mechanical removal of dental plaque. The types of brushes are manual, powered, ionic and sonic brushes. Hand brushing requires a certain degree of manual dexterity. A number of investigations showed that children are generally not capable of obtaining a sufficient oral hygiene level by manual brushing due to their underdeveloped motor skills, lack of knowledge about oral hygiene and effective brushing, less amount of time spent on brushing than recommended or a combination of these. Hence ionic and powered brushes have been introduced to facilitate tooth cleaning and improve the oral hygiene of the patient.⁷

Oral-B complete action Power Deep clean tooth brush is battery operated that uses rotated head with criss cross bristle which improve cleaning action. Oral-B cross action pro-health manual tooth brush having criss-cross bristles which removes plaque from tight interproximal spaces.⁸,⁹ The efficacies of the two brushes were compared using Silness-Löe plaque index which is easy to record and simple to evaluate. This is based on recording both soft debris and mineralized deposits on four surfaces (buccal, mesial, distal and lingual) of the six teeth (16, 12, 24, 36, 32, 44).¹⁰

Both the brushes significantly reduced the plaque accumulation, though powered brushing a greater degree. Similar results were obtained from the study conducted by Lazarescu et al. Jongenelis, Martin et al. (1987), Baab and Johnson, and Preber et al. (1991).⁵,⁸,⁹

The results of the present study differ from those reported by William et al. in which they compared the effectiveness of an electric brush and a regular hand brush in preventing or removing dental plaque and concluded that both brushes were equally effective in removing plaque.¹⁰

**DISCUSSION**

This study was designed to evaluate the potential advantage of powered brush over manual brush in removing plaque. Numerous clinical studies have shown a direct relationship between oral hygiene status, the quality of plaque, and the prevalence and severity of periodontal diseases.³

Mechanical plaque control is done by daily cleaning with toothbrush and other oral hygiene aids. Tooth brushing is primary mechanical mean of removing plaque, thereby preventing gingivitis and, to some extent, controlling dental caries.⁶

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**TABLE 2: PLAQUE INDEX AFTER ONE MONTH**

<table>
<thead>
<tr>
<th>Score</th>
<th>Powered brushing n(%)</th>
<th>Manual brushing n(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1(2.8)</td>
<td>1(2.8)</td>
</tr>
<tr>
<td>1</td>
<td>19(54.3)</td>
<td>20(57.1)</td>
</tr>
<tr>
<td>2</td>
<td>13(37.1)</td>
<td>12(34.2)</td>
</tr>
<tr>
<td>3</td>
<td>2(5.7)</td>
<td>2(5.7)</td>
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</tbody>
</table>

**TABLE 3: PLAQUE INDEX AFTER THREE MONTHS**

<table>
<thead>
<tr>
<th>Score</th>
<th>Powered brushing n(%)</th>
<th>Manual brushing n(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>6(17.1)</td>
<td>5(14.3)</td>
</tr>
<tr>
<td>1</td>
<td>25(71.4)</td>
<td>22(62.8)</td>
</tr>
<tr>
<td>2</td>
<td>4(11.4)</td>
<td>6(17.1)</td>
</tr>
<tr>
<td>3</td>
<td>0(0)</td>
<td>2(5.7)</td>
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</table>

Fig 1: Gender distribution of the study participants

Fig 2: Gender distribution in study groups
In this study, the powered group showed significantly more plaque reduction as compared to the manual group. The result probably can be attributed to a better feeling with new technology power brushes, more time given to powered brushing or quantity of tooth pastes. Further study is recommended with large sample, controlled time, amount of tooth paste and brushing under supervision.

CONCLUSION

Both brushes significantly reduced the plaque accumulation, though to different degrees. The powered group showed significantly more plaque reduction as compared to the manual group.

REFERENCES

1 Nikiforuk G. Understanding dental caries, prevention basic and clinical aspect, New York, Karger publication; 1985.