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A comparison between two methods of brushing on clinical periodontal parameters in patients with fixed orthodontic appliance

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Abstract

Fifty four orthodontic patients wearing upper and lower fixed appliances were assigned either an electric tooth brush or a manual tooth brush. Each patient was instructed and trained on the proper use of the allocated brush. Clinical parameters included (Plaque index, Gingival index and Eastman interdental bleeding index) were measured at base line, at 4 weeks and at 8 weeks. Data for each group were analyzed using paired t-test.

Patients using electric tooth brush and manual one showed a significant reduction in all clinical parameters at 4 and 8 weeks, but the reduction of the values of all parameters in electric brush group is higher than in manual group and the difference is statically significant.

The present study concluded that electric tooth brush is real alternative to the often laborious manual tooth cleaning procedures used during active appliance therapy.

Introduction

Periodontal diseases and dental caries, both plaque related diseases are recognized as two of the most common diseases world wide and it has long been recognized that the presence of dental plaque leads to gingivitis and periodontal disease, as well as caries.

^(1,2) Fixed orthodontic appliances are found to be one of the most common retentive factors of dental plaque ^(3,4). Trapped debris and plaque that accumulate gingivally to orthodontic wire are difficult to remove ⁽⁵⁻⁹⁾. Today tooth brushing is the most widely accepted method of removing plaque and has a very high degree of social acceptability ⁽¹⁰⁾. Tooth brushes now come in bewildering range of styles and varieties accomplished by complex product descriptions and scientific

design theories, but no research team has yet come up with conclusive proof that one brand performs better than others ⁽¹¹⁾. Good plaque control is an important factor in the maintenance of dental health during fixed appliance therapy ⁽¹²⁻¹⁴⁾.

In pursuit of enhanced plaque control, manual tooth brushes have been designed specifically for use by orthodontic patients but have not been deemed superior to conventional brush in reducing gingivitis ^(15,16). Rotary and counter rotational electrical brushes, however, have generally demonstrated greater plaque capabilities compared to various types of manual tooth brushes in orthodontic patients ⁽¹⁷⁻¹⁹⁾.

Only one study has shown plaque removal to be superior with a manual

brush⁽²⁰⁾. Electric tooth brushes using a normal brush head or a brush designed specifically for use by orthodontic patients has also been shown to be as effective as a manual brush in removing plaque⁽²¹⁻²³⁾. Despite reduced plaque accumulation in electric brushing studies, concomitant improvements in the health of the gingiva of fixed orthodontic patients are not as convincing. Only one long-term study⁽²⁴⁾ has demonstrated a significantly persistent reduction in gingival inflammation levels in the electric tooth brush group compared to the manual tooth brush group.

The present study was conducted to evaluate the effectiveness of electric and manual tooth brushing in orthodontic patients with fixed orthodontic appliances and make a comparison between the two methods of brushing on clinical periodontal parameters.

Materials and methods

The sample of this study consisted of fifty four patients who attended the consultant orthodontic clinic at college of dentistry, Al-Mustansiria University. Those patients were undergoing treatment with both upper and lower fixed orthodontic appliances who fulfilled the inclusion and exclusion criteria listed in table I.

The sample of the study included 27 subjects (12 boys and 15 girls) were allocated the electric brush and the other 27 subjects (13 boys and 14 girls) were allocated the manual brush. The mean age for subjects in electric brush group was 14.1 ± 1.7 years and in the manual brush group 15.6 ± 1.9 years.

These patients were randomly assigned to the test electrical tooth brush (Triza, Switzerland) or to the control group manual tooth brush (Triza, Switzerland). Baseline

measurements of plaque and gingival health were recorded for each participant. After patients were assigned to the trial groups, oral hygiene instruments were given to each patient for the use of allocated brush. Each subject's brushing competency and understanding were checked and no further tooth brushing instruction was given throughout the study. The participants were instructed to brush two times daily, after breakfast and before retiring at night, using the allocated brush. The use of interdental cleaning aids was not permitted during the study. Each patient was issued a fluoride containing tooth paste free from anti-plaque and anti-calculus agents. All patients were also supplied with a fluoride mouth rinse and asked to rinse with 10 ml once daily throughout the study.

The examinations at baseline, 4 weeks and 8 weeks were conducted. The participants had brushed their teeth after breakfast as usual. Recordings were made by using the plaque index⁽²⁵⁾, gingival index⁽²⁶⁾, and Eastman interproximal bleeding index⁽²⁷⁾. Plaque scores were recorded for 4 zones (incisal, distal, mesial and gingival to the bracket or band) on the labial or buccal aspects of the teeth. A WHO periodontal probe was used inside the gingival crevice to record the gingival index. All traces of gingival bleeding were removed by rinsing or by gentle stream of air and water before recording the Eastman interdental bleeding index. From the buccal aspect, a wooden interdental stick was inserted four times between the teeth, depressing the interdental papilla by 1-2 mm. After 15 seconds, the presence or absence of bleeding was noted and recorded.

The Eastman interdental bleeding index was calculated from the number

of bleeding sites as a percentage of the total sites that were assessed.

The mean and standard deviation for each of the 3 parameters recorded (plaque index, gingival index and interdental bleeding) was calculated for each time point. Analyses looking for changes within the individual groups were conducted using paired t-test. Comparisons of the 2 study groups were made using LSD test.

Results

For both study groups, the reduction in the three parameters assessed were seen among and this reduction is apparent. In electrical group, the PI was reduced from 1.32 in (V1) to 0.31 in (V3), while for manual group the mean PI was decreased from 1.28 in (V1) to 0.62 in (V3).

The same trend of changes was observed for GI, the mean was reduced from 1.82 in (V1) to 0.6 in (V3) and from 1.77 in (V1) to 0.98 in (V3) for electrical and manual group respectively. For interproximal bleeding in electrical group, the bleeding percentage was reduced from 47.9% in (V1) to 22.2% in (V3) for electrical group and from 49.5 % to 37.8 % for manual group.

For comparison between the two study groups, t-test was used and the results showed that for plaque index, gingival index and we used Chi square for bleeding index. The difference was significant in (V2) and (V3) while it is not in (V1). (Tables II, IV, and VI).

The LSD test and Chi square were used to compare the differences in mean values for all parameters between visits in both study groups. The reduction was significant from visits to another for both study groups in all clinical parameters studied. (Tables III, V, VII)

Discussion

The current study gives important information on the efficacy of an electrical tooth brush, compared to a manual tooth brush on the periodontal health of patients undergoing orthodontic fixed appliance therapy in a hospital clinic.

Observation of plaque removal in tooth brushing trials in orthodontic patients vary in one day to two months.^(21,22) Those which incorporate measurements of gingival changes usually run for a minimum of 4 weeks as over this period clinically meaningful alterations in plaque and gingival bleeding have been recorded in orthodontic groups.^(28,29) The eight-week duration of the present study falls in line with recommendation in the ADA acceptance program guide lines for tooth brush. That the trial should extend over a minimum of 30 days⁽³⁰⁾. While long term dental hygiene practices at home are more likely to be reflected in trial regime can become problematic, there by providing an imprecise assessment of the efficacy and usefulness of a tooth-brush⁽²⁸⁾.

Over an eight-week period, the electrical tooth brushing group exhibited a significant reduction in mean plaque scores, which may be due to involvement in the trial; the formal hygiene instruction given at the time of tooth brush allocation especially the subjects allocated the electric brush were given specific instructions with regard to tooth brushing. This result confirms the finding of other studies.^(7,12,31)

Mean gingivitis scores were reduced significantly at 4 and 8 weeks in electrical brush group and this result supposed to be reasonable and proportional with the reduction of plaque accumulation that occurred in this group of the study. Similar results were found in other previous trials⁽¹²⁾.

The usefulness of each brush in the interdental area was assessed using Eastman Bleeding Index. The value of this index in assessment of the efficacy of interdental hygiene measures has been emphasized.⁽³²⁾

Subjects allocated the electric tooth brush exhibited a statistically significant reduction in mean percentage of interdental bleeding scores over the trial period, confirming the findings of Clerehugh et al.⁽²¹⁾

This most likely reflects the ability of the specific small head design to access interdental areas, but also may be due to a caustic micro streaming⁽³³⁾.

It may be concluded that electric toothbrushes are real alternative to the often laborious manual tooth cleaning procedures used during active appliance therapy. Patients with poor oral hygiene and inefficient manual dexterity and compliance may benefit from electric tooth brushes especially because the plaque removal can be achieved easier and faster.

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Table I: Inclusion and Exclusion Criteria for the Trial subjects

Inclusion Criteria	Exclusion Criteria
Good general health Aged between 10 and 20 years Wearing upper and lower pre-adjusted edgewise fixed appliances Brush at least once per day willing and able to comply with trial regime Dentally fit Gingival bleeding on at least 20% of sites	Medical contra-indications including those requiring antibiotic cover Immunosuppressant drugs Poor manual dexterity Poor compliance Poor periodontal health including presence of supragingival calculus, subgingival calculus, or periodontal pocketing Active caries Oral prophylaxis in previous 4 weeks Use of antibiotics or antibacterial mouth rinses during the trial Current use of a powered tooth brush

Tables II: Mean per visit of Plaque, Gingivitis and Percent of bleeding for Electrical and Manual toothbrushes

	Electrical brush mean	Manual brush mean
Plaque		
Visit 1	1.32	1.28
Visit 2	0.67	0.9
Visit 3	0.31	0.62
Gingivitis		
Visit 1	1.82	1.77
Visit 2	0.95	1.32
Visit 3	0.6	0.98
Bleeding (%)		
Visit 1	47.9	49.5
Visit 2	31.2	43.9
Visit 3	22.2	37.8

Tables III: T-test between electrical and manual tooth brush for Plaque index

	t-test	Sig.
Visit 1	0.3517	N.S.
Visit 2	5.645	S.
Visit 3	3.278	S.

Tables IV: LSD test between visits in Plaque index

	Electrical brush		Manual brush	
	test	Sig.	test	Sig.
V.1 vs V.2	82.68	H.S.	3.014	S.
V.1 vs V.3	82.7	H.S.	4.83	S.
V.2 vs V.3	3.617	S	2.632	S.

Tables V: T-test between electrical and manual tooth brush for Gingival index

	t-test	Sig.
Visit 1	0.375	N.S.
Visit 2	5.016	S.
Visit 3	8.406	S.

Tables VI: LSD test between visits in Gingival index

	Electrical brush		Manual brush	
	test	Sig.	test	Sig.
V.1 vs V.2	5.418	S.	3.09	S.
V.1 vs V.3	7.137	H.S.	5.04	S.
V.2 vs V.3	3.133	S	2.69	S.

Tables VII: Chi-square test for percentage of bleeding index

	χ^2	Sig.
Visit 1	6.87	S.
Visit 2	21.03	H.S.
Visit 3	32.99	H.S.

Tables VIII: Chi-square test between visits in bleeding index

	Electrical brush		Manual brush	
	χ^2	Sig.	χ^2	Sig.
V.1 vs V.2	25.601	H.S.	3.99	S.
V.1 vs V.3	33.36	H.S.	21.03	H.S.
V.2 vs V.3	16.18	H.S.	12.71	H.S.