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Comparison of the Effectiveness of Different Types of Toothbrushes on the Oral Hygiene of Orthodontic Patients

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Abstract

Orthodontic treatment with fixed appliances is a risk factor for plaque accumulation. The maintenance of oral hygiene is therefore essential to prevent the occurrence and severity of gingivitis and periodontal disease. Thus, this study aimed to evaluate the effectiveness of different types of toothbrushes in eliminating plaque in patients undergoing fixed orthodontic treatment. Sixty orthodontic patients were selected and randomly divided into four groups and bonded bracket plaque index was used to score plaque on teeth with brackets at baseline and after one-month duration. There was a significant reduction in plaque pre- and post-brushing with all four types of toothbrushes. However, there was no significant difference between the toothbrushes.

Keywords: Dental Plaque, Oral Hygiene, Orthodontic Appliances, Toothbrush.

Introduction

Oral hygiene is one of the most important issues in patients undergoing orthodontic treatment with fixed appliances because brackets tenaciously trap food and other oral debris. Although long-term reports concerning the health of the periodontal tissues of orthodontic patients are controversial[1-2].

Oral hygiene measures are always instituted as bands, brackets, ligature wires, and elastics, encourage the accumulation of microbial flora and food residue, which in time cause periodontal disease and caries.

Effective methods of plaque removal for patients with fixed appliances could be beneficial. Mechanical cleaning of the tooth surface can be accomplished in various forms [3-6], and toothbrushing is routinely advised to prevent plaque accumulation.

Different types of brushes have evolved for oral hygiene maintenance such as interdental brushes, brushes with an additional tip for better cleaning, zig-zag brushes, etc.

Amidst the plethora of toothbrushes available, the orthodontic brush is one of the additions to the armamentarium of oral hygiene devices.

Hence, the present study was conducted to compare the effectiveness of four different types of commercially available toothbrushes in preserving periodontal health during fixed orthodontic treatment. No such study was carried out earlier.

Materials and Method

Sixty patients undergoing orthodontic treatment in the department of orthodontics were randomly selected with fully bonded edgewise appliances in both the arches.

To enrol in the study, the subjects need to meet the following inclusion criteria:

1) Male and female participants aged between 13 to 20 years.
2) Patients with fixed orthodontic appliances in both arches, same material with similar ligature-tie methods
3) Belonging to similar socioeconomic status.
4) Minimum 20 natural teeth

Exclusion criteria

1) Underlying periodontal or systemic disease.
2) Under antibiotics in the past two months.
3) Use of floss, mouth rinses, and tooth-whitening products
4) Presence of prosthetic crowns and bridges.
5) History of allergies to dentifrice products

The samples were randomly divided into four groups and the investigators were blinded to the brushes used by the subjects, only one investigator was aware of the subjects in that group.

1. Group 1- Fifteen subjects received Stim orthodontic toothbrush.
2. Group 2 - Fifteen subjects received Colgate 360 toothbrushes.
3. Group 3 - Fifteen subjects received a Colgate Zig-Zag toothbrush.
4. Group 4 - Fifteen subjects received Colgate conventional toothbrushes.

The microbial plaque was made visible by using a plaque-disclosing solution and Bonded Bracket Plaque Index[7] was recorded for both upper and lower arches on each patient at the baseline and after one month of investigation.

Study assessments made on the vestibular tooth surface of all the teeth were given scores of 0-5 using the following classification:

0: No microbial plaque

1: Microbial plaque only on the bracket

2: Microbial plaque on the bracket and tooth surface, but not spreading towards the gingiva.

3: Microbial plaque on the bracket and tooth surface, spreading towards the papilla.

4: Microbial plaque on the bracket and tooth surface. Part of the gingiva is covered with plaque.

5: Microbial plaque on the bracket and tooth surface. Gingiva is covered with plaque.

Statistical Analysis

The scores were tabulated and subjected to statistical analysis.

Nonparametric statistical methods were used since scoring systems were used in measurements. The Mann-Whitney U test was used for the intergroup and the Wilcoxon test was used for intragroup comparisons at the baseline and after one month of the study.

In addition, mean and standard deviation were calculated for all the groups.

Results

Table I- Comparison of Pre-brushing and post-brushing (Bonded Bracket Plaque Index)-UPPER ARCH

Groups	Pre-brushing	Post-brushing	Difference
Stim orthodontic toothbrush	3.8±5.9	1.1±0.51	2.8±0.56
Colgate 360 toothbrush	4±0	1.2±0.56	2.8±0.56
Colgate Zig-Zag toothbrush	4±0	1.8±0.74	2.1±0.74
Colgate Conventional toothbrush	4±0	1.8±0.77	2.2±0.77

p=0.13

Table II -Comparison of Pre-brushing and post-brushing (Bonded Bracket plaque Index)-LOWER ARCH

Groups	Pre-brushing	Post-brushing	Difference
Stim orthodontic toothbrush	6.9±0.83	2.1±0.83	4.8±1.65
Colgate 360 toothbrush	4.8±1.01	1.5±0.64	3.3±0.79
Colgate Zig-Zag toothbrush	4.5±0.91	2±0.53	2.5±1.18
Colgate Conventional toothbrush	5.8±0.51	2.9±1.33	2.9±1.43

p=.001

There was a statistically significant difference between pre-brushing and post-brushing index scores among all 4 groups in both arches. However, there was no statistically significant difference between the groups.

Discussion

Dental plaque is the primary etiological factor in the development of gingivitis which will eventually lead to periodontitis. Oral hygiene maintenance is necessary for orthodontic patients to prevent caries and periodontal disease during and after fixed orthodontic treatment.

Among all the mechanical methods, plaque control using mechanical toothbrushes stands to be the primary beneficial home care method. There is no evidence that one specific toothbrush design is superior to another. Thus, the present study was conducted to evaluate the efficacy of four commercially available toothbrushes in orthodontic patients.

The study subjects were divided into 4 groups consisting of 15 participants in each named group-1, group-2, group-3, and group-4 who used Stim orthodontic toothbrush, Colgate 360 toothbrush, Colgate zig-zag toothbrush, Colgate standard toothbrush respectively for plaque elimination.

The subjects were constantly motivated to use the assigned toothbrushes and toothpaste because some toothpaste affect plaque and gingival indices according to the study done by Wilcoxon et al[12]. All the subjects brushed with a modified bass brushing technique, for a minimum of two minutes to ensure thorough brushing.

One approach to scoring plaque is planimetric plaque analysis, which expresses the plaque area as a percentage of the tooth surface covered with plaque. Several such indices have been developed over the years, most notably those advocated by Silness and Lo¨e[13], O’Leary[14], and the modified Quigley and Hein index[15].

The suitability of these indices in orthodontic patients with brackets is questionable.

The bonded bracket plaque index advocated by Kilicoglu et al to determine the amount of microbial plaque accumulation on teeth with brackets was used in this study and scoring was done at the baseline and after one month.

Stim (ortho MB) toothbrush is a specially designed toothbrush for cleaning teeth with brackets. it has a special V-cut for improved cleaning of braces along with teeth. The Colgate 360 toothbrush is designed to promote good oral hygiene, this toothbrush has different bristle sizes that facilitate biofilm removal in the interproximal region, and a tongue cleaner to remove tongue coating.

A study by Nageshwar et al, showed a significant reduction in plaque scores irrespective of the gender of participants, with the use of Colgate 360 whole mouth clean soft toothbrush in non-orthodontic patients.[8]

In the present study the zigzag toothbrush is equally effective as the other toothbrushes and no significant differences were observed between the brushes, these results were in accordance with Sripriya et al[9], and Mendiratta et al[10], but a similar comparison study by Chakrapani et al[11], showed that the zigzag toothbrush removed more plaque compared to the other types of toothbrushes.

However, all four toothbrushes showed a significant reduction of plaque scores (p-value <0.05) in both the arches (tables I and II). To prevent the Hawthorne effect, which is a form of reactivity whereby subjects improve an aspect of their behaviour being experimentally measured simply in response to the fact that they are being studied, subjects refrained from using dental floss or any other oral hygiene aids during the course of the study and 6-7hours before the assessment of scores.

William et al[16], Yeung and Howell[17] tested the efficiency of oral hygiene programs instituted before and after orthodontic therapy and did not find any changes in plaque elimination between the groups. These results were found to be consistent with our findings.

The outcome of the present study indicates that the use of all four types of toothbrushes was effective in reducing plaque, but there was no significant difference in the different types of brushes. However, the duration of this study was over a short period of one month, hence further studies can be taken with longer follow-up periods to evaluate the efficacy of different types of brushes in plaque elimination in orthodontic patients.

Conclusion

1) The present study showed a significant difference in the reduction of plaque with all four types of brushes over a period of one month.
2) There were no significant differences between the four brushes in plaque removal efficiency. Hence there is no unique toothbrush for plaque elimination.
3) The presence of brackets and archwires decreases the efficacy of plaque elimination in interproximal areas. So interdental brushes or flossing may be of help to the patients and also patients must be constantly informed regarding the merits of toothbrushing for better oral hygiene.

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