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Research Paper: Effective Tooth Brushing Technique to Manage Periodontal Diseases in Orthodontic Patients: A Double-Blind Randomized Controlled Trial

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ABSTRACT

Introduction: Orthodontic treatment can cause difficulties in maintaining good oral hygiene leading to the accumulation of dental plaque, gingival inflammation, periodontal disease, and caries. This study aimed to evaluate the efficacy of three different tooth brushing techniques on the prevention of periodontal diseases in patients with fixed orthodontics treatment.

Materials and Methods: In this parallel-group, double-blind randomized controlled trial, 57 patients undergoing fixed orthodontic treatment with mild gingivitis were randomly divided into three groups (scrub, modified Stillman, and modified bass) using a simple randomization technique. The patients were instructed to brush their teeth three times a day and to floss once a day. Gingival (Silness and Loe) and plaque indices (O'Leary and Quickly hein) were recorded at baseline, after 2 weeks and after 3 months. ANOVA and Post Hoc tests were used; otherwise, Kruskal-Wallis test and Post Hoc tests were used in SPSS 24. The significance level was set at $p>0.05$.

Results: Gingival index and plaque indices (Quickly hein and O-Leary) significantly decreased when using 3 methods of tooth brushing (respectively $p>0.001$, $p<0.05$ and $p>0.001$). However, age and gender had no statistically significant relationship with recorded periodontal parameters in the three groups of subjects.

Conclusion: All three studied methods were effective in the reduction of gingival and plaque indices in patients undergoing orthodontic treatment.

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Introduction

Dental plaque is a white to yellowish or greyish substance bonding to teeth and leading to gingival inflammation, periodontal diseases, enamel demineralization, and caries. (1-2) Mechanical and chemical methods can reduce and control plaque levels.(3) However, achieving optimal plaque control is challenging for patients undergoing orthodontic treatment due to the physical barriers of their appliances and increased food retention areas specifically in fixed orthodontics.(4)

Tooth brushing is the easiest, most cost-effective, and most widespread mechanical method of controlling plaque.(5) Different methods of tooth brushing were introduced including the rotational technique (modified Stillman), vibrational technique (Stillman, Charters or Bass), circulation technique (Fones), perpendicular technique (Leonard), and horizontal techniques (scrub).(6,7)

In the study of Nassar et al., the Bass technique was found to be more effective than the Horizontal technique, followed by the Modified Stillman Technique (MST) in reducing the gingival index (GI).(8) However, the Horizontal technique was found to be more effective than the MST followed by the Bass technique in reducing the plaque index (PI).(8) Alanazi et al. stated that the Modified Bass Technique (MBT) was significantly more effective in plaque control compared to MST when combined with an oblique distal grip or an oblique grip.(9)

To date, studies assessing the plaque control and oral hygiene of orthodontic patients using different methods of tooth brushing are still lacking. The aim of this research is to compare the efficiency of different tooth brushing techniques on the prevention of plaque formation and gingival disease in patients undergoing fixed orthodontic treatment.

Materials & Methods

Study Design

The current parallel-group, double-blind randomized controlled trial including a total of 57 patients was carried out from July 2019 to July 2020. Ethical clearance was obtained from the Ethical Committee. All patients or their parents (if under 18 years) signed informed consent prior to the study. CONSORT 2010 guideline was applied. Eligibility criteria and method were not changed during the trial.

Eligibility Criteria

Patients undergoing fixed orthodontic treatment, suffering from mild gingivitis, having at least 20 teeth, and aged 12≤ years were recruited for the study. Patients with systemic diseases or conditions such as diabetes or pregnancy, smoking, and consumption of alcohol, previous periodontal surgery were excluded.

The sample size was considered to be 57 patients according to the study of Nasser et al. (2013)

Patients Recruitment and Group Assignment

The participants were recruited from patients referred to the periodontics department if they satisfied the inclusion criteria. A researcher (NK) assessed whether the referral patients had fulfilled the inclusion criteria.

A simple randomization technique was used. “Group 1”, “Group 2” and “Group 3” were written on 19 papers each and were placed in opaque envelopes. Each patient selected one envelope, which was kept in a box. According to the group written in the letters, patients were allocated to group 1, group 2, or group 3 at an allocation ratio of 1:1:1.

Clinical Examination

GI and PI were recorded at the baseline by a researcher (DM) who was not aware of the allocation sequence. Silness-Loe gingival Index was recorded as 0 (no inflammation), 1 (low inflammation), 2 (medium inflammation), and 3 (significant inflammation). O’Leary (i.e., recording plaque in each tooth) and Quickly hein (i.e., plaque level in the non-filled surface of each tooth, except for the wisdom tooth) were measured to assess PI. The values were scored as the following: 0 (no plaque presence); 1 (isolated strains in gingival margin); 2 (one attached band of plaque with the size of 1 mm at the gingival margin); 3 (a plaque with the width of more than 1 mm which has covered one-third

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of the dental surface); 4 (a plaque which has covered one-third to two-thirds of the dental surface); and 5 (a plaque which has covered more than two-thirds of the dental surface).

The indices were re-measured two weeks, and three months after the onset of the study.

Blinding and intervention

The researcher who measured the clinical parameters (DM) and the participants were blinded in the study. To blind the participants, they were not informed about the hypotheses to be tested, the three conditions, and the name of the technique taught to each group.

The groups 1, 2, and 3 were educated to use the scrub, MST, and MBT, respectively. The patients were instructed to brush their teeth 3 times/day for 2 minutes each time using the given toothbrush and toothpaste, to floss once a day, and to avoid using an-mouthwash during the study for 3 months.

Statistical analysis

Relevant tables and figures were used for reporting the obtained descriptive results. In addition, with the assumption of data normality, Analysis of Variance (ANOVA) and Post Hoc tests were used; otherwise, Kruskal-Wallis test and Post Hoc tests were used in SPSS 24 (IBM Corp, Armonk, NY, USA). The significance level was set at P>0.05.

Results

The current study was conducted to compare the efficiency of scrub, MST, and MBT on GI and PI of 57 patients receiving fixed orthodontic treatment. Table1 shows the demographic data of participants enrolled in the study. The mean age of patients was 21±79.

Table1: Age- and gender-wise distribution of participants

		Percent (Number)
Gender	Female	73.7% (41)
	Male	26.3% (16)
Age	≤20yrs	49% (28)
	≥20yrs	51% (29)

No significant difference was found in efficacy of 3 tooth brushing methods in reducing GI, Quickly hein PI, and O'Leary PI according to gender (respectively p=0.381, p=0.569, p=0.524). The current study failed to find significant differences in the reduction of GI, quickly hein PI, and O'Leary PI in the 3 groups of participants according to age (respectively p=0.508, p=0.344, and p=0.379).

The intragroup comparison of GI among the scrub, MST and MBT, revealed that in the 2nd week GI was significantly higher in the MBT, compared to the scrub and MST (p=0.014 and p=0.012 respectively). However, the difference was not significant between scrub and MST. The same findings were found after 3 months. GI was significantly higher in MBT compared to the other two methods (respectively p= 0.018 and p=0.018). GI had significantly decreased after 3 months in the scrub, MST, and MBT groups (respectively p=0.001, p=0.007, and p=0.001). (Fig 1)

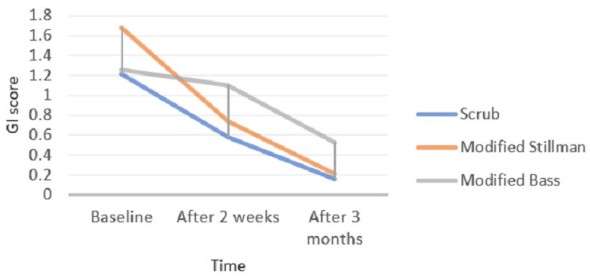

Fig 1: Mean of the gingival index based on time in 3 groups

The intragroup comparison of Quickly hein PI among the scrub, MST, and MBT, showed that in the 2nd week and 3rd month, the Quickly hein PI index was significantly higher in MBT compared to Scrub (respectively p=0.018 and p=0.026) and MST (respectively p=0.018 and p=0.004). The index decreased significantly after 3 months in groups 1, 2, and 3 (respectively p=0.001, p=0.001, and p≤0.001). (Fig 2)

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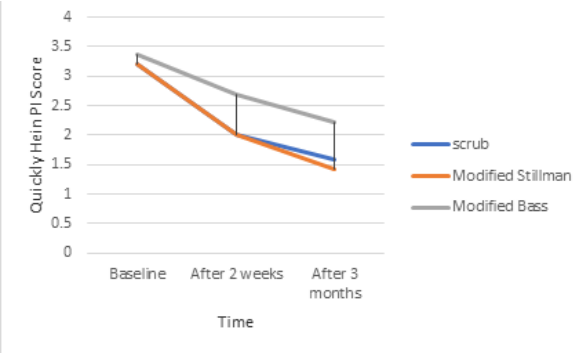

Fig 2: Mean of Quickly hein plaque index based on time in each group

The results of intragroup comparison of O'Leary PI among the scrub, MST, and MBT, demonstrated that in 2nd week and 3rd month, the index was significantly higher in the MBT group compared to the scrub method (respectively $p \leq 0.001$ and $p=0.001$) and MST (respectively $p \leq 0.001$ and $p=0.001$). O'Leary index decreased significantly after 3 months in groups 1, 2, and 3 (respectively $p \leq 0.001$, $p=0.001$, and $p=0.001$). (Fig 3)

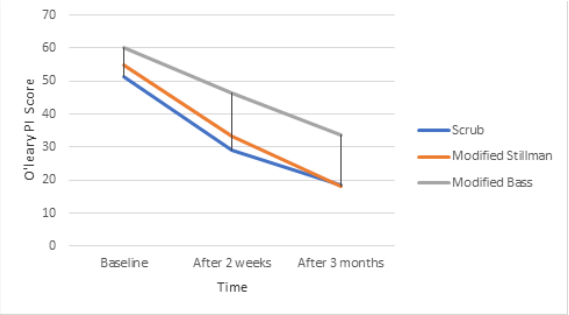

Fig 3: Mean of O'leary plaque index based on time in each group

Discussion

Oral hygiene is of importance following orthodontic therapy.(10) Poor oral hygiene leads to complications such as enamel demineralization, white spot lesions, caries, halitosis, plaque and calculus formation, gingival inflammation, and periodontal diseases.(10-11) Achieving acceptable oral hygiene through efficient tooth brushing is challenging after the placement of fixed orthodontic appliances.(10) For this reason, providing the most advantageous tooth brushing technique for the patients undergoing fixed orthodontic treatment should be sought to prevent from above-mentioned complications.(10)

The current study was conducted to compare the efficiency of scrub, modified Stillman, and modified Bass techniques on GI and PI of 57 patients receiving fixed orthodontic treatment.

Kudirkaite et al. assessed the effect of age and gender on indices such as bleeding on probing (BOP), PI, GI, and probing pocket depth (PPD) in patients having orthodontic appliances. The patients reported how often they brushed their teeth using a questionnaire. Kudirkaite et al. stated that females were more consistent in tooth brushing compared to males.(12) And also, observed that patients aged 16-18 brushed their teeth more frequently compared to younger patients.(12) On the contrary, findings of the current study showed that age and gender had no significant effect on recorded periodontal parameters. Considering the methodology and participants' age, the different results may be explained. In the study of Kudirkaite et al., a questionnaire was used to evaluate the regularity of tooth brushing in males and females, however in the current study all patients were instructed to brush 3 times a day and to use dental floss, then the efficacy of different tooth brushing methods was assessed. (12) Also, in the study of Kudirkaite et al., participants were divided into 2 groups according to age (12-15 years old and 16-18 years old) but in this study, patients were categorized as younger than 20 or older than 20 years old which can explain the reason of different results. (12)

Nassar et al. evaluated the reduction of periodontal parameters (GI and PI) of patients undergoing orthodontic therapy using the scrub, MST, and Bass tooth brushing methods through a 9-month period. (8) In their study, the PI score had reduced consistently in 9 months in all 3 groups. (8) However, the results demonstrated that reduction of GI was only significant from 6th to 9th month in all groups. (8) They stated that the Bass method was more effective than the other two methods. (8)In accordance with Nassar et al., the results of McClure and Sangnes et al. showed that MBT was more effective in in

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terdental plaque removal compared to the scrub method. (13,14)Also, Alanazi et al. stated that MBT was significantly more effective in plaque control compared to MST.(9) While in the current study, all three methods were significantly effective in reducing GI, quickly hein PI, and O'Leary PI. Also, Smutkeeree et al. claimed that there was no significant difference between MBT and the scrub method in reducing GI and PI. (15) These controversies may be due to different follow-up periods, assessment of different gingival and plaque indices, and different tooth brushing methods evaluated in each study.

Many studies have evaluated the effectiveness of different toothbrush types on periodontal management of patients undergoing orthodontic treatment, (3) however, studies assessing the efficacy of toothbrushing methods in managing periodontal diseases of orthodontic patients, are lacking. Further studies are required with larger sample size and long-term follow-ups to determine the most effective tooth brushing method for orthodontic patients. Also, it is recommended that future studies compare other tooth brushing methods.

Scrub, modified Stillman & modified Bass methods were significantly effective on the reduction of gingival and plaque indices in patients undergoing orthodontics.

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