Effectiveness of Instructional Methods for Modified-Stillman Brushing Technique: Experimental Trial

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Abstract

Background: Finding the ideal instructional methods to achieve effective plaque removal is challenging.

Objective: This study aims to measure the most effective method for providing instructions for Modified-Stillman Brushing Technique.

Materials and Methods: This was a single blind randomized controlled trial conducted on 101 male and female participants aged 18 - 40 at Qassim University Dental Clinics. They were randomly divided into 5 groups. Group 1: no instructions (control). Group 2: brochure with written instruction only, NO illustrations. Group 3: brochure written+ illustrated instructions. Group 4: brochure with written+ illustrated instructions+ video. Group 5: verbal instructions and demonstration on a dental model. Silness and Loe Plaque index measurements were obtained before and after brushing. While brushing, they were evaluated for their brushing technique. Paired t-test and ANOVA were used to test associations where appropriate.

Results: At the baseline, all groups showed a significant difference (P = .000) with regard to the plaque measurement before and after brushing. Arranging the groups from the least scored to the highest would be Group 1 < Group 2 < Group 3 < Group 4 < Group 5. There was no significance recorded in the first plaque measurement or the second plaque measurement between all groups when compared together.

Conclusion: There was a significant difference among the groups regarding the brushing technique application. The difference between the plaque levels were not significant between the groups. This suggests that any method of brushing will reduce plaque. It is imperative to practice proper brushing techniques since not accomplishing the correct methods may result in adverse effects on the dentition such as gingival recession.

Keywords: Modified Stillman; Brushing Technique Instructions; Silness and Loe Plaque Index; Oral Hygine

Abbreviations

MSBT: Modified Stillman Brushing Technique; MBT: Modified Bass Technique

Introduction

Dental plaque is a biofilm that causes diseases such as dental caries, gingivitis and periodontitis. [1] Complete elimination of dental plaque is not possible: however, frequent mechanical plaque control methods could help reduce the occurrence of diseases [1].

Brushing is the primary mechanical plaque control method to remove the accumulated plaque in order to prevent those diseases and maintain good oral hygiene [2].

Preventive dentistry comes as a priority and it aims to save the teeth and oral tissues from the different oral pathogens through controlling the normal levels of microflora by the individuals themselves. Many individuals are unaware of the proper brushing techniques, they may even brush their teeth two times daily but fail to completely remove the plaque present [3-5]. Therefore, instructions for brushing techniques are important and should be demonstrated to the dental patients.

Different brushing techniques may be a difficult task to properly learn and form a habit of as it involves several repetitive motions and movements in different angles to cover all the teeth surfaces. Since learning how to properly brush may be difficult, many oral health education programs develop different methods to educate individuals effectively. The goal they try to achieve is to educate the individuals of the different brushing techniques while ensuring that they properly apply them.

A few trials have chosen the Modified Stillman's tooth brushing technique to be the technique of choice for individuals who have abrasion due to previous improper brushing techniques. Although Bass technique is considered the most effective technique to remove dental plaque, we preferred the Modified Stillman's tooth brushing technique as it does not irritate the teeth and gingiva and it's a variation from the Bass technique [6,7].

In a study testing for the most effective toothbrushing technique it was found that modified Bass technique was the best, not only it can reduce the plaque supragingivally but it can reach up to 0.5 mm depth sub-gingivally. Other study testing the efficacy of the modified Stillman's and Charter's techniques showed how effective it was in plaque removal apart from adaptability, compliance and reliability of this technique being inconsistently reported along with no side effect whatsoever in all the seven trails [8]. Many brushing techniques have been implemented with various movements and steps; however, the bass technique has been proven to remove the most amount of plaque compared to others. Several studies used and recommend the modified bass technique for plaque removal [9].

Modified Stillman brushing technique in this study was described as the following verbally and on the dental model: First the toothbrush is placed at 45 degrees with the bristles placed on the gums and on the tooth surface, then slight movements are made, after that the toothbrush is rolled coronally passing through the entire tooth length. This is repeated 5 - 10 times for each area [10]. Additionally, a systematic approach should be followed in order to avoid missing any areas. Rateitschak., *et al.* (1985) suggest starting at the facial upper right quadrant moving towards the upper left quadrant then continuing to the lower left quadrant and ending at the lower right quadrant. By this method all the facial surfaces would be covered. After debriding the facial surface, the distal and oral (palatal and lingual) surfaces are approached. Beginning by brushing the distal surface of the most posterior tooth on each quadrant then the palatal surface of the upper right quadrant moving toward the upper left quadrant then the lingual surface of the lower left quadrant and finally the lower right quadrant. This systematic approach ensures that all surfaces would be covered adequately [11].

The American Dental Association®, recommends using a soft bristled toothbrush [12]. Most dental practitioners believe that medium bristled toothbrushes cause more abrasion than soft bristles. It has been proven that it is not the bristle hardness that causes abrasion but rather the force by which the toothbrush is used. A soft bristled toothbrush used at a higher force may cause more abrasion than a medium bristled toothbrush [13].

Several studies have explained and compared different brushing techniques; however, only a few have actually measured the effectiveness of brushing technique instructional methods.

The effectiveness of individual's brushing technique is affected by their skills, behavior and the method by which they received plaque control instructions [2].

Aim of the Study

This study aims to measure the most effective method for providing instructions for Modified Stillman brushing technique (MSBT).

Materials and Methods

This study is a single blind randomized controlled trial conducted at Qassim University Dental Clinics. It was approved by the Ethical Committee and Research and Presentation skills committee at College of Dentistry - Qassim University before its application and it was applied according to the World Medical Association Declaration of Helsinki guidelines. The research was conducted in one stage and performed on one hundred and five (105) male and female adult participants aged 18 to 40 years old (mean age 26.21) chosen according to the criteria below.

The sample size was chosen according to convenience, patients attending Qassim University Dental Clinics and matched the inclusion criteria were enrolled the research. This is a clinical research and therefore not representative of the population; further field studies are needed.

The participants' inclusion criteria:
- Participants who are able to brush their teeth and comply with the research requirements.
- Participants having at least 5 teeth per quadrant.

The participants' exclusion criteria will be:
- Any participant unable to brush their teeth.
- Edentulous individuals or individuals having less than 5 teeth per quadrant.
- Participants with disabilities limiting their hand/wrist movements.
- Participants unable to read or understand instructions.
- Participants who have allergies to any of the materials used in the research.
- Participants who are familiar with the dental field [4].
- Participants who used chlorohexidine mouthwash during the last 12 hours prior to conducting the study [10].
- Participants who performed mechanical removal of plaque (brushing) during the previous hour [1].

All the materials for the research were prepared and supplied by the same researcher who distributed them among the others. Researchers received training prior to performing the study. The materials used for the research consisted of a toothbrush (Biorepair®) and a toothpaste (Blanx®) (Figure 1), University of Michigan 'O' Probe With Williams Markings, Marquis Color-Coded Probe, dental mirror, ipad, and participant's file (Figure 2).

*(Biorepair®) Toothbrush and (Blanx®) Toothpaste: COSWELL SPA. Via P. Gobetti n. 4 - 40050 Funo (BO) Italy.

The toothbrush used consisted of round end nylon bristles with medium hardness and the brushing plane was flat. Its handle was straight and had indentations on the front and back side to ensure firm griping. The shank was angled forwards to provide better access to various areas.

The study was explained to the participants and informed consent obtained before conducting the research. Each participant picked a folded paper from a paper cup that determined which group they would be part of (Figure 2). The participants were randomly divided

Figure 1

Figure 2
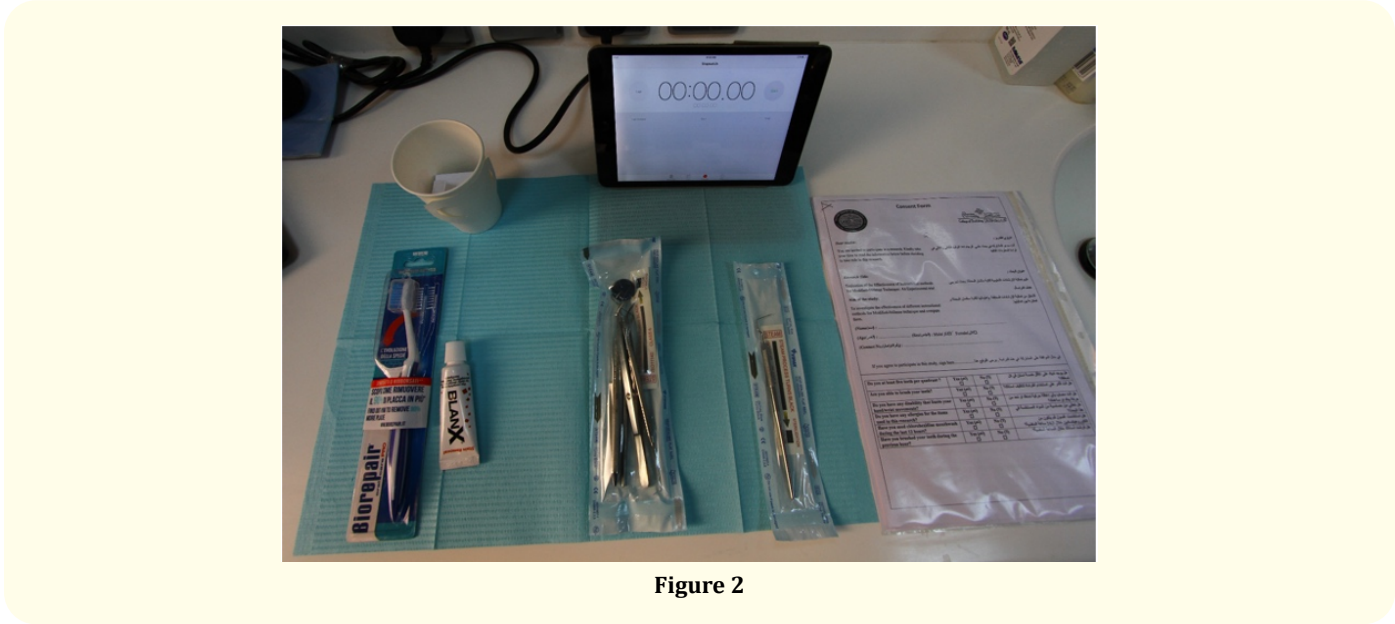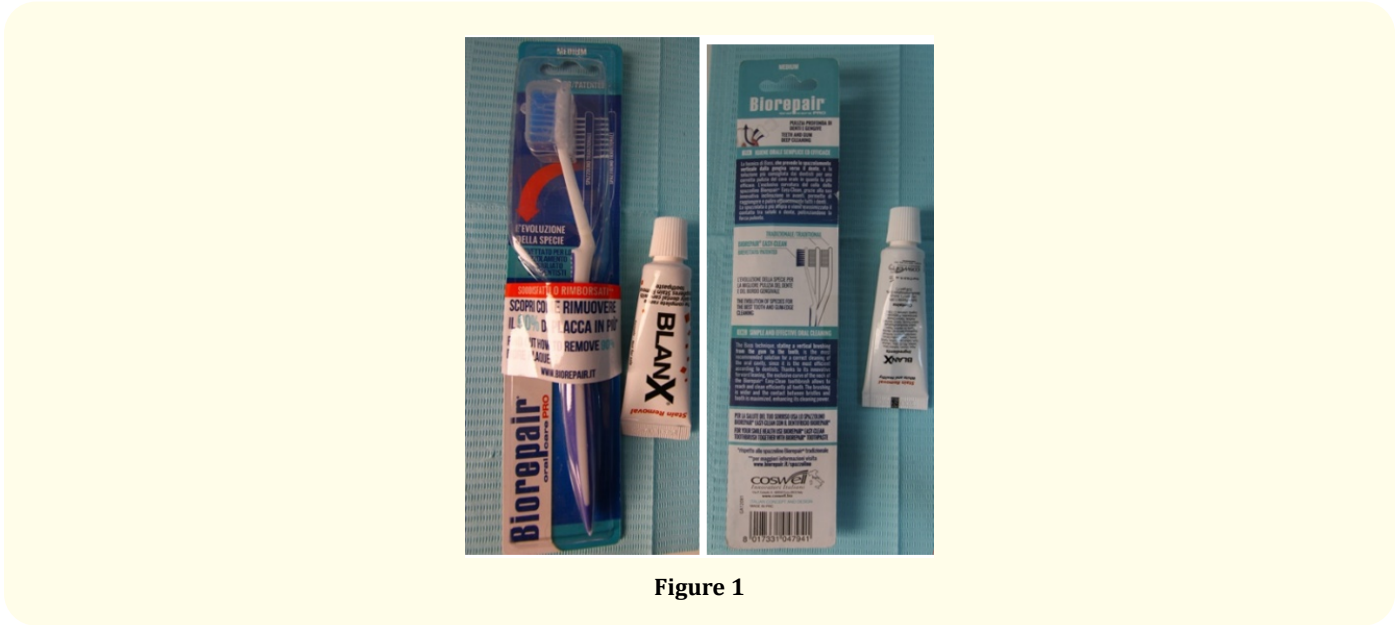
into five groups shown in table 1. The consent form, survey, and brochures were provided in both English and Arabic language so any language barrier could be avoided.

Silness and Loe Plaque index [16] was measured before and after the participant had brushed his/her teeth (Figure 9). Any missing tooth was replaced with a neighboring tooth. The participants were given the same type of toothbrush and toothpaste and asked to

Group 1	Control: No instructions
Group 2	Brochure [14]: Written instruction only NO illustrations (Figure 3 and 4)
Group 3	Brochure [14]: Written + illustrated instructions (Figure 5 and 6)
Group 4	Brochure [13]: Written + illustrated instructions + video (Figure 5-7) [15]
Group 5	Verbal instructions and demonstration on a dental model (Figure 8)

Table 1

Note: Groups 2 - 5 will be given instructions for modified Stillman technique.

Figure 3

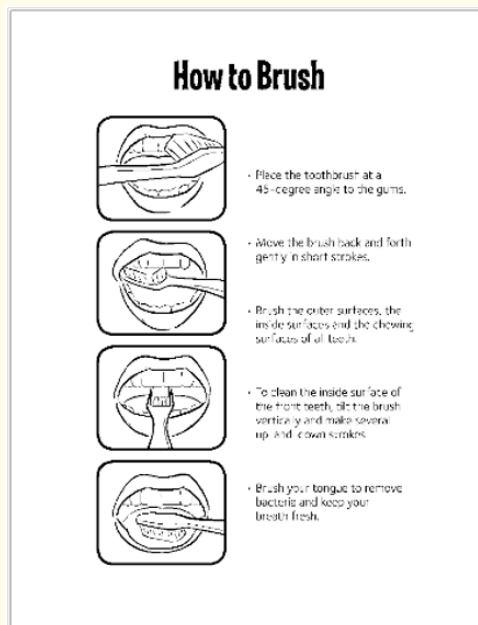**Figure 4**

Figure 5

Figure 6

Figure 7

Figure 8

Figure 9

brush their teeth in the dental clinic/cubicle at the sink area facing a mirror and were informed that a mirror was present if they needed it (Figure 10). As they were brushing the instructor evaluated their brushing technique while checking an ipad displaying iOS stopwatch which was placed near the sink area before conducting the research (Figure 11 and 12). They were also instructed to inform us when they had finished brushing their teeth. Then the second plaque index was measured. After obtaining the second plaque index measurement all participants (except group 5 since they have already seen the demonstration) were shown the proper brushing technique using the dental model so all participants may benefit. Finally, the participants were asked fill in a survey and allowed to take the toothbrush and toothpaste home. They were instructed to throw away the plastic cap, since it encourages the accumulation of bacteria [17]. Throughout the entire study the participant did not know to which group he/she belonged, nor did he/she know what other educational methods the other groups received.

Figure 10

Figure 11

Manner	Score		
	0	1	2
Placed **Pea-sized** amount of toothpaste			
Placed the toothbrush at a **45-degree** angle to the gums.			
Moved the brush back & forth			
Rolled the brush outwards			
Brushed the **outer surfaces** of all teeth			
Brushed **inside surfaces** of all teeth			
Brushed the **chewing surfaces** of all teeth			
Tilted the **brush vertically** & made up-and-down strokes in anterior teeth			
Brushed their **tongue**			
Brushed for **2 minutes** in total			
Total:			

Score	Criteria
0	Failed to apply the manner
1	Manner partially adopted
2	Manner completely adopted

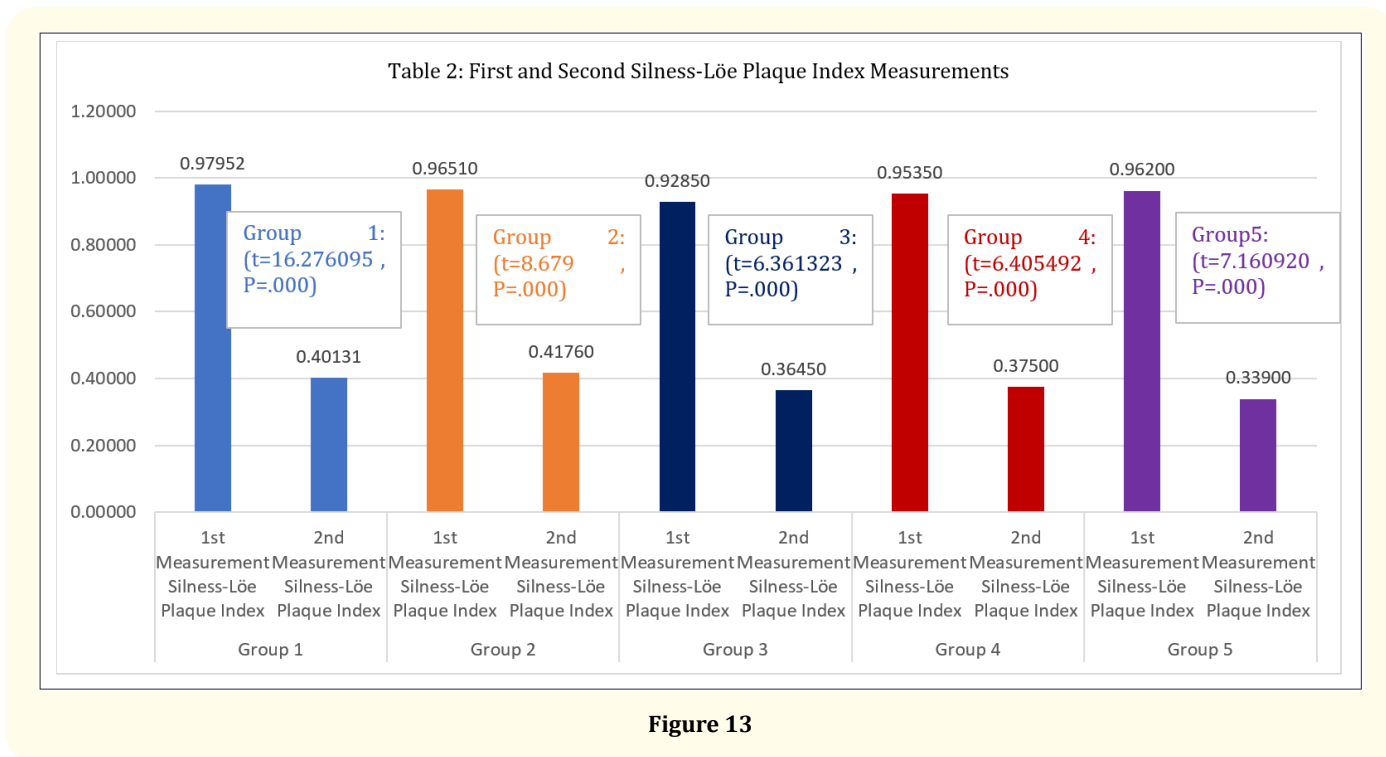**Figure 12**

Statistical analysis

IBM SPSS Statistics version 25 for Windows 10 was used. All statistical analysis and tables were performed using acceptable methods. Each group and the brushing technique applied was statistically analyzed using Paired T test individually, then all the groups were tested together with Paired T test. ANOVA was used for multiple group comparison for evaluation of the brushing technique, first plaque measurement and second plaque measurement. Crosstabs (chi square) were performed between the participant's sex and group against the survey questions individually. Crosstab test was performed for the participant's age and evaluation of the oral hygiene instructional methods, it was also performed between the groups and evaluation of the brushing technique.

Data was analyzed by using the SPSS software package for Windows (version 20.0; SPSS Inc., Chicago, USA). All statistical analyses were carried out at a significance level less than 0.05 and 0.01. The data was analyzed and subjected to calculating means, standard deviations. Additionally, paired t-test will be used to compare the brushing method in the form of scoring of plaque index before and after introducing instructional methods for Modified-Stillman Technique. (MSBT) Also, analysis of variance (ANOVA) was used for multiple group comparison.

Results

4 out of 105 male and female participants who provided written consent participated in the research were excluded because they were not in the age range included in the research. A total of 101 were included divided as: (Group 1: 10 male and 10 females; Group 2: 10 male and 10 females; Group 3: 10 male and 10 females; Group 4: 10 male and 10 females; Group 5: 10 male and 11 females). All 101 participants completed the study since it was performed at one stage and there was no follow up required.

At the baseline all groups showed a significant difference with regard to the plaque measurement before and after brushing their teeth. (reject the null hypothesis) (Figure 13).

Figure 13

Citation: Faten Ahmad Alsoweed., *et al.* "Effectiveness of Instructional Methods for Modified-Stillman Brushing Technique: Experimental Trial". *EC Dental Science* 19.10 (2020): 71-89.

- Group 1: (t = 16.276095, P = .000)
- Group 2: (t = 8.679, P = .000)
- Group 3: (t = 6.361323, P = .000)
- Group 4: (t = 6.405492, P = .000)
- Group 5: (t = 7.160920, P = .000).

All groups together at Paired T-test: (t = 16.265070, P = .000).

When comparing the evaluation of the brushing technique of all the groups with each other by ANOVA method, the following was observed (Table 2 and 3):

		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
					Lower	Upper			
Group 1	1st Measurement Silness-Löe Plaque Index - 2nd Measurement Silness-Löe Plaque Index	.578218	.357028	.035526	.507736	.648700	16.276	100	.000
Group 2	1st Measurement Silness-Löe Plaque Index - 2nd Measurement Silness-Löe Plaque Index	.547500	.282114	.063083	.415467	.679533	8.679	19	.000
Group 3	1st Measurement Silness-Löe Plaque Index - 2nd Measurement Silness-Löe Plaque Index	.564000	.396503	.088661	.378431	.749569	6.361	19	.000
Group 4	1st Measurement Silness-Löe Plaque Index - 2nd Measurement Silness-Löe Plaque Index	.578500	.403893	.090313	.389472	.767528	6.405	19	.000
Group 5	1st Measurement Silness-Löe Plaque Index - 2nd Measurement Silness-Löe Plaque Index	.623000	.389076	.087000	.440907	.805093	7.161	19	.000

***Table 2:** Paired differences.*

Paired Samples Test						
		Paired Differences				
		Mean	Std. Deviation	t	df	Sig. (2-tailed)
Group 1	1st Measurement Silness-Löe Plaque Index - 2nd Measurement Silness-Löe Plaque Index	.578218	0.357028	16.276	100	0.000
Group 2	1st Measurement Silness-Löe Plaque Index - 2nd Measurement Silness-Löe Plaque Index	.547500	0.282114	8.679	19	0.000
Group 3	1st Measurement Silness-Löe Plaque Index - 2nd Measurement Silness-Löe Plaque Index	0.564000	0.396503	6.361	19	0.000
Group 4	1st Measurement Silness-Löe Plaque Index - 2nd Measurement Silness-Löe Plaque Index	0.578500	0.403893	6.405	19	0.000
Group 5	1st Measurement Silness-Löe Plaque Index - 2nd Measurement Silness-Löe Plaque Index	0.623000	0.389076	7.161	19	0.000

***Table 3:** Paired T test for 1st and 2nd plaque measurements after adding t,df.*

- There was a significant difference between group 1 and groups 3, 4 and 5. There was no significant difference recorded between groups 1 and 2. All the other group participants performed/scored better than group 1.

- There was a significant difference between group 2, and groups 4 and 5. There was no significant difference recorded between group 2 and groups 1 and 3. Group 2 participants performed better than group 1 but less than the other groups.

- There was a significant difference between group 3 and groups 1 and 5. There was no significant difference recorded between group 3 and groups 2 and 4. Group 3 participants performed better than groups 1 and 2 but less than groups 4 and 5.

- There was a significant difference between group 4, and groups 1, and 2. There was no significant difference recorded between group 4 and groups 3 and 5. Group 4 participants performed better than all groups except group 5.

- There was a significant difference between group 5, and groups 1, 2 and 3. There was no significant difference recorded between groups 5 and 4. Group 5 participants performed the best out of all groups.

- A significant difference was shown when comparing all the groups with regard to the scores of the evaluation of the brushing technique (crosstabulation chi square). Reject the null hypothesis. Likelihood ratio: Value = 79.903797, P = 0.20 (Table 4).

- The age of the participants did not show any significance with regard to the efficacy of the brushing technique (Table 5).

- There was no significance recorded in the first plaque measurement or the second plaque measurement between all groups when compared together. All groups generally had high plaque scores which decreased after brushing (Table 6).

- No significant difference was noticed when comparing the participants' genders and evaluation of the brushing technique scores (Table 7).

- Crosstab (chi square) of the questionnaire questions and the genders was performed, all were non-significant except the following:

- "Which method of brushing you follow to clean your teeth?" (Value = 30.122067, P = .000) (Figure 14).

- "How many times you clean your teeth in a day?" (Value = 33.479, P = .000) (Table 8).

Case Processing Summary						
	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Group * Evaluation of Brushing Technique	101	100.0%	0	0.0%	101	100.0%

Chi-Square Tests		
	Value	Asymptotic Significance (2-sided)
Pearson Chi-Square	70.223a	.096
Likelihood Ratio	79.904	.020
Linear-by-Linear Association	35.508	.000
N of Valid Cases	101	

(I) Group		Mean Difference (I-J)	Sig.	95% Confidence Interval	
				Lower Bound	Upper Bound
Group 1	Group 2	-1.200	0.166	-2.91	0.51
	Group 3	-2.350*	0.007	-4.06	-0.64
	Group 4	-3.900*	0.000	-5.61	-2.19
	Group 5	-5.574*	0.000	-7.26	-3.89

ANOVA					
Evaluation of Brushing Technique					
	Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Between Groups	395.047	4	98.762	13.363	0.000
Within Groups	709.488	96	7.391		
Total	1104.535	100			

Table 4

Case Processing Summary						
	Cases					
	Valid		**Missing**		**Total**	
	N	**Percent**	**N**	**Percent**	**N**	**Percent**
Age * Evaluation of Brushing Technique	101	100.0%	0	0.0%	101	100.0%

Chi-Square Tests		
	Value	**Asymptotic Significance (2-sided)**
Pearson Chi-Square	292.527a	.728
Likelihood Ratio	216.894	1.000
Linear-by-Linear Association	2.467	.116
N of Valid Cases	101	

Table 5

ANOVA 1st Measurement Silness-Löe Plaque Index					
	Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Between Groups	0.146	4	0.036	0.145	0.965
Within Groups	24.13	96	0.251		
Total	24.276	100			

Multiple Comparisons						
Dependent Variable: 1st Measurement Silness-Löe Plaque Index						
LSD						
(I) Group		**Mean Difference (I-J)**	**Std. Error**	**Sig.**	**95% Confidence Interval**	
					Lower Bound	**Upper Bound**
Group 1	Group 2	-0.005900	0.158543	0.970	-0.32060	0.30880
	Group 3	0.036600	0.158543	0.818	-0.27810	0.35130
	Group 4	0.003100	0.158543	0.984	-0.31160	0.31780
	Group 5	-0.077757	0.156644	0.621	-0.38869	0.23318

ANOVA					
2nd Measurement Silness-Löe Plaque Index					
	Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Between Groups	0.285	4	0.071	0.679	0.608
Within Groups	10.072	96	0.105		
Total	10.357	100			

Multiple Comparisons						
Dependent Variable: 2nd Measurement Silness-Löe Plaque Index						
LSD						
(I) Group		**Mean Difference (I-J)**	**Std. Error**	**Sig.**	**95% Confidence Interval**	
					Lower Bound	**Upper Bound**
Group 1	Group 2	-0.075400	0.102429	0.463	-0.27872	0.12792
	Group 3	0.053100	0.102429	0.605	-0.15022	0.25642
	Group 4	0.078600	0.102429	0.445	-0.12472	0.28192
	Group 5	0.034743	0.101202	0.732	-0.16614	0.23563

Table 6

Case Processing Summary						
	Cases					
	Valid		**Missing**		**Total**	
	N	**Percent**	**N**	**Percent**	**N**	**Percent**
Sex * Evaluation of Brushing Technique	101	100.0%	0	0.0%	101	100.0%

Chi-Square Tests		
	Value	**Asymptotic Significance (2-sided)**
Pearson Chi-Square	15.962a	.316
Likelihood Ratio	19.032	.164
Linear-by-Linear Association	.829	.362
N of Valid Cases	101	

Table 7

Case Processing Summary						
	Cases					
	Valid		**Missing**		**Total**	
	N	**Percent**	**N**	**Percent**	**N**	**Percent**
Sex * 11) How many times you clean your teeth in a day?	101	100.0%	0	0.0%	101	100.0%

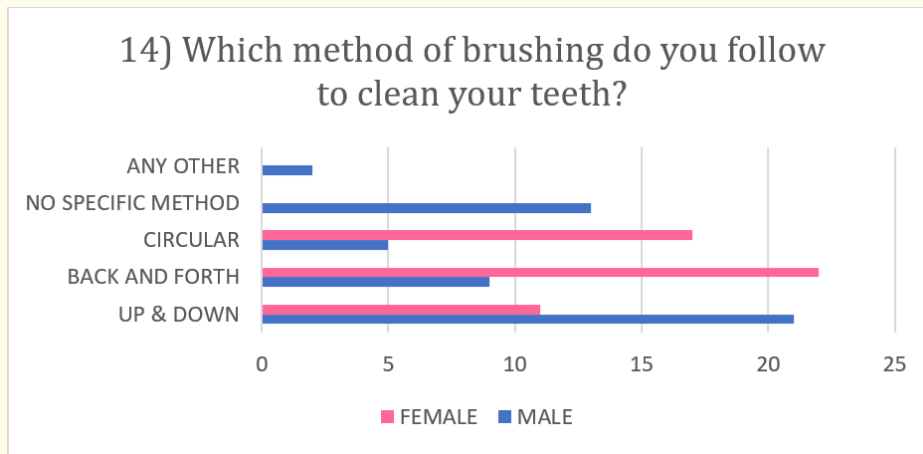| Chi-Square Tests		
	Value	**Asymptotic Significance (2-sided)**
Pearson Chi-Square	33.479a	.000
Likelihood Ratio	40.609	.000
Linear-by-Linear Association	.988	.320
N of Valid Cases	101	

Table 8

Figure 14

Discussion

Oral hygiene practice has not been thoroughly studied in Saudi Arabia, proper oral hygiene application is not common in the Saudi Arabian population as many individuals do not apply basic oral hygiene measures [18,19].

This randomized single blind controlled experimental trial attempted to teach participants the Modified Stillman brushing technique (MSBT) through different methods and compare them.

The hawthorne effect occurs when an individual improves the way they perform a specific act/task because they know they are being observed [20]. It does not apply to this study since the participants were required to perform their best application of the brushing technique which they had just learnt. Group 1 did not know what specific actions they were being evaluated for nor did they know the Modified Stillman technique or any specific brushing technique.

Several participants didn't look at the mirror through the entire brushing period and reverted to their normal brushing habits and some preferred to keep their heads down near the sink and completely avoided using the mirror. Others only looked at their reflections

to ensure that the toothbrush was held at the correct angle towards the teeth then looked away (dazed off). Most of the participants held the toothbrush with the palm grasp method. Every participant placed the amount of force with the toothbrush on the teeth according to what they thought was required. The amount of force was assessed based on the grip by which the toothbrush handle was held, the facial expression the participant had as a response to that applied pressure in addition to pinpoint bleeding spots noticed after. Several participants appeared to brush aggressively or placed too much force. Only a few placed a light amount of force by holding the handle with less force. Most participants thought that a large amount of force was needed to be placed in order to properly brush the teeth. Placing too much force while brushing should be avoided since it may cause abrasion [13].

All the other group participants performed/scored better than Group 1. Group 2 participants performed better than group 1 but less than the other groups. Group 3 participants performed better than groups 1 and 2 but less than groups 4 and 5. Group 4 participants performed better than all groups except group 5. Group 5 participants performed the best out of all groups. Arranging the groups from the least scored to the highest would be Group 1 < Group 2 < Group 3 < Group 4 < Group 5.

Our research supports results achieved by another research which used Modified Bass technique instead such as Schlueter., *et al* [3]. The Group 5 participants receiving the live demonstration on a dental model achieved the highest scores when compared to the brochure groups (Group 2, 3, 4) and video group (Group 4). This research suggests that the best method to teach the proper oral hygiene for Modified-Stillman Technique is through a live demonstration on a model and a video showing the brushing technique with an additional brochure to summarize the steps and assist the patients in memorizing them.

There was no significant difference between the groups regarding the plaque scores, all groups had high plaque scores which reduced after brushing. This may be due to the fact that any method of mechanical plaque removal (brushing) will remove plaque. Nightingale., *et al*. [5] informed participants to brush their teeth and did not give them any instructions. Even with the absence of instructions, the participants were able to remove plaque.

Schlueter., *et al*. (2013) concluded that the plaque levels were not dependable on the correct brushing technique application. This research resulted in a significant difference between the groups regarding the brushing technique application; however, the difference between the plaque levels were not significant between the groups [9]. This emphasizes that any method of brushing will reduce plaque, but as we mentioned earlier Bass technique and Modified Bass technique were proven to be the most effective techniques to remove dental plaque.

Most of the participants successfully removed plaque; however, not all the proper brushing technique steps were performed. Not all the participants were able to properly learn and apply the brushing technique and perform them immediately, this may be due to not having enough time to properly assess the individual's progress or learning ability.

Asif M., *et al*. [2] study had four groups and each group was further divided into reinforcement and non-reinforcement groups, the reinforcement group received further training for three days after the initial training all groups received. Using "Turesky-Gilmore- Glickman modification of Quigley-Hein plaque index"; baseline measurement was taken one week prior to the second measurement. No significant difference was found between the reinforced and non-reinforced group.

Based on this finding we decided to apply our study in one stage without reinforcement group but unfortunately this turned out to be a weakness.

A training period might have been necessary in order for all the patients to master the brushing technique to effectively remove all plaque. Park., *et al*. [21] measured plaque levels after teaching individuals the Modified Bass Technique MBT after one week, two weeks, and three weeks intervals and concluded that plaque levels did improve with time. In their study, they divided his participants into two groups; one group received a demonstration only, the other received a demonstration in addition to a chairside practice. The group which received a chairside practice scored better (plaque index measures) than the demonstration only group. This also indicates that a practice period is required to properly learn a brushing technique.

It is imperative to practice proper oral brushing techniques since not following the correct methods for brushing may result in adverse effects on the dentition such as gingival recession and abrasion [13,22,23].

Furthermore, brushing with and without a dentifrice did not prove to be significant with regard to reducing the plaque measurements according to Pathak [6] which suggests that the amount of dentifrice used did not affect the plaque scores nor did the increase in the amount of brushing time show any significance with regard to plaque score reduction.

Only seven of our participants were undergoing orthodontic treatment, those patients were not excluded since it has been proven that manual brushing is effective in reducing the plaque index around the brackets. The differences in the plaque removal on the teeth with brackets and teeth without brackets were insignificant in Saruttichart T., *et al*. (2017) study [24].

This systemic review compared the modified bass technique with an orthodontic brushing technique and found that the later was significantly higher in reducing the gingival plaque index when compared to the modified bass technique, however there were no significant difference in the total plaque index (mesial, distal, occlusal) [25]. There is an insufficient amount of studies that recommend a specific brushing technique for orthodontic patient [26].

Conclusion

Patients should be educated about the drawbacks of faulty brushing techniques. Motivating them alone may not be enough, but training and encouraging them to maintain their oral health through proper brushing techniques could produce desirable effects. They should understand that they are in control of their oral health and may act accordingly to aid themselves [18].

Recommendation

A training period is recommended before conducting the evaluation to ensure they properly absorb and practice the instructions.

Further research is needed to study the instructional methods with regard to plaque scores (The brushing technique learnability should be studied more). More oral health education programs should be provided to improve the oral health of the Saudi Arabian people.

Acknowledgements

Bibliography

1. Vasudevan R. "Dental Plaques: Microbial Community of the Oral Cavity". *Journal of Microbiology and Experimentation* 4.1 (2017): 00100.

2. Chatterjee A., *et al.* "Assessment of Efficacy of Different Teaching Methods of Tooth Brushing on Oral Hygiene Status in Adults". *Journal of Health Science Research* 8.1 (2017): 25-30.

3. Schlueter N., *et al.* "Adoption of a toothbrushing technique: a controlled, randomised clinical trial". *Clinical Oral Investigations* 14.1 (2010): 99-106.

4. Naseem S., *et al.* "Oral Hygiene Practices and Teeth Cleaning Techniques Among Medical Students". *Cureus* 9.7 (2017): e1487.

5. Nightingale KJ., *et al.* "Toothbrush efficacy for plaque removal". *International Journal of Dental Hygiene* 12.4 (2014): 251-256.

6. Pathak L. "Toothbrushing with and without dentifrice -A comparative study". *Bangladesh Journal of Dental Research and Education* 5.1 (2015): 6-10.

7. Alanazi KJ., *et al.* "Influence of tooth brush grips and brushing techniques on plaque removal efficacy". *Journal of Dentistry and Oral Health* 107.4 (2017): 1-7.

8. Janakiram C., *et al.* "The Efficacy of Plaque Control by Various Toothbrushing Techniques-A Systematic Review and Meta-Analysis". *Journal of Clinical and Diagnostic Research* 12.11 (2018): 1-6.

9. Schlueter N., *et al.* "Relationship between plaque score and video-monitored brushing performance after repeated instruction--a controlled, randomised clinical trial". *Clinical Oral Investigations* 17.2 (2013): 659-667.

10. Balagopal S and Arjunkumar R. "Chlorhexidine: The Gold Standard Antiplaque Agent". *Journal of Pharmaceutical Sciences and Research* 5.12 (2014): 270-274.

11. Rateitschak K., *et al.* "Color atlas of dental medicine". Stuttgart: Thieme. (1985): 112-115.

12. ADA Science Institute. Oral Health Topics: Toothbrushes (2017).

13. Joshi CP., *et al.* "Comparative evaluation of cemental abrasion caused by soft and medium bristle hardness toothbrushes at three predetermined toothbrushing forces: An *In vitro* study". *Journal of Indian Society of Periodontology* 21.1 (2017): 10-15.

14. American Dental Association. How to Brush (2005).

15. Ahmed S. Modified Stillman Technique (2017).

16. Tayanin GL. Silness-Löe Index (2010).

17. Mehta A., *et al.* "Bacterial contamination and decontamination of toothbrushes after use". *The New York State Dental Journal* (2007).

18. El Bcheraoui C., *et al.* "Use of dental clinics and oral hygiene practices in the Kingdom of Saudi Arabia, 2013". *International Dental Journal* (2013).

19. Alhussain M. "Dental Health among Adult Saudi Nationals in Buraydah Qassim". *International Journal of Science and Research* 7.2 (2018): 978-984.

20. McCarney R., *et al.* "The Hawthorne Effect: a randomised, controlled trial". *BMC Medical Research Methodology* 7 (2007): 30.

21. Park D-Y., *et al.* "Effect of the education interval and method on improving Patients plaque control ability". *Journal of Korean Academy of Oral Health* 39.2 (2015): 145-151.

22. Mythri S., *et al.* "Etiology and occurrence of gingival recession - An epidemiological study". *Journal of Indian Society of Periodontology* 19.6 (2015): 671-675.

23. Özgöz M., *et al.* "Relationship between handedness and toothbrush-related cervical dental abrasion in left- and right-handed individuals". *Journal of Dental Sciences* 5.4 (2010): 177-182.

24. Saruttichart T., *et al.* "Effectiveness of a motionless ultrasonic toothbrush in reducing plaque and gingival inflammation in patients with fixed orthodontic appliances". *The Angle Orthodontist* 87.2 (2017): 279-285.

25. Kang A. "An orthodontic tooth brushing technique to enhance oral hygiene in patients with fixed appliances: interim results of a randomized controlled clinical trial [Thesis, Master of Health Sciences]. University of Otago (2015).

26. Nassar PO., *et al.* "Periodontal evaluation of different toothbrushing techniques in patients with fixed orthodontic appliances". *Dental Press Journal of Orthodontics* 18.1 (2013): 76-80.