Effect of Text Messages Regarding Use of Manual Toothbrush and Power Toothbrush in Young Adult Patients with Fixed Orthodontic Appliances on Oral Hygiene Status: A Prospective Study

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Abstract:

Introduction: This study aimed to determine the effect of text messages regarding the use of manual toothbrushes and power toothbrushes on oral hygiene status in patients with fixed orthodontic appliances. **Material and methods:** 81 ongoing orthodontic patients (age 14-23) were divided into three equal groups. Group I and group II were provided a manual toothbrush and the participants of Group III were provided a power toothbrush. Text messages regarding the benefits of good oral hygiene were sent to Group II and Group III whereas Group I did not receive any message. Gingival index (GI), Plaque index (PI), and Eastman's interdental bleeding index (EIBI) were evaluated at baseline (T0), 4 weeks (T1), and 12 weeks (T2). **Result:** For intragroup and intergroup comparisons, Paired t-tests and ANOVA tests were performed. Patients of all three groups, whether they were informed by text messages or not, showed an increase in GI, PI, and EIBI scores from baseline (T0) to 4 weeks (T1). When scores were compared with paired t-test over a period of 12 weeks (T0 -T2), all the indices (GI, PI, and EIBI) showed a statistically significant difference for the non-text message group (Group I). **Conclusion:** Sending text messages about oral hygiene directly to the patient's WhatsApp account is an effective way to encourage the orthodontic patient to maintain proper oral hygiene.

Keywords: Power Toothbrush, Manual Toothbrush, Eastman's interdental bleeding index.

INTRODUCTION

One of the most critical parameters that the patient may manage throughout orthodontic therapy is oral hygiene compliance. Bands, brackets, wires, and ligatures are fixed appliance components that trap food and debris, resulting in plaque formation. Almost all orthodontic patients with fixed appliances face oral hygiene problems, leading to gingivitis, which eventually causes the periodontium to deteriorate, resulting in gingival recession, pocket development, hyperplasia, and periodontal disease depending on its severity.[1–9] According to research done by Al-Jewair, dental hygiene declined rapidly after the bonding but improved by the fifth month of therapy.[10] However, K. Cantekin et al.[11] found that oral hygiene difficulties are more prevalent near the completion of orthodontic therapy, emphasizing the difficulty in maintaining consistent and appropriate oral hygiene throughout orthodontic treatment. Orthodontists have long been concerned with plaque removal and dental hygiene compliance,[12-16] which can result in less satisfactory outcomes. In view of the availability of variety of toothbrush types with their appealing marketing tactics, clinical research is

required to determine their efficacy in order to provide expert advice for orthodontic patients. Numerous clinical investigations done on patients undergoing fixed orthodontic treatment investigated the efficacy of several manual and powered toothbrush types with standard and innovative designs, but the results of the study were conflicting.[17] Halitosis is common, and upto 50% of the population is said to experience halitosis to varying degrees.[18] According to the study, however, there lack of reliable proof that patients using traditional or self-ligated fixed orthodontic appliances have halitosis while undergoing treatment.[19]

In addition to regular tooth brushing, orthodontists utilize a range of techniques to encourage patients to practice excellent oral hygiene. Text messaging has proven to be a valuable technique in research for behavior change and disease prevention in dentistry.[20] Another research showed that text message alerts to the parents of orthodontic patients were an excellent way to enhance their children' dental hygiene.[21]

The objectives of this study were to see how text messages affected the oral hygiene of two separate groups that used manual and powdered tooth brushes when compared to a control group who did not receive any text messages.

MATERIAL AND METHODS

Approval for the study was taken by the institutional ethical committee. Using a research article by Sharma Ruchi et al.[17] a sample size of 69 subjects was determined at a 95% confidence interval and 80% power, which is 23 per group. This study was approved by the human subject's ethics board (TMDCRC/IEC/19-20/0D05) and was conducted in accordance with the Helsinki Declaration of 1975, as revised in 2013. Once ethical clearance was obtained, 81 patients (n=27 per group) with full fixed appliances in both arches who had completed a minimum of 3 months of their treatment and had at least a minimum of 6 months of remaining treatment were selected from the orthodontic department over a period of 5 months (April, 2021 to August, 2021) considering possibility of dropouts. Each patient gave written consent to participate in the study and agreed to receive text messages over WhatsApp prior to the commencement of the research. The patients were randomly divided into three equal groups.

The groups used in this study were:
Group I: comprised 14 males and 13 females. The mean age of this group was 16.82 (±1.8) years, with a range of 14 to 23 years. No text reminder regarding brushing/oral hygiene was sent to them. Participants of this group were provided with regular manual toothbrush (Oral -B regular toothbrush, India ltd (medium consistency).

Group II: The mean age of the participants, 12 males, and 15 females, was estimated to be 17.26 (±1.3) years, with a range of 15 to 22 years. They were provided with a manual toothbrush (Oral -B regular, India ltd (medium consistency), and were reminded about the benefits of cleaning their teeth by text message on their WhatsApp account.

Group III: consisted of 11 males and 16 females, who were provided with motorized power toothbrushes (Oral -B, India ltd, medium consistency), and were informed on their WhatsApp accounts by text messages about the importance of brushing in regulating oral health. The mean age of this group was 17.65

(±1.5) years, with an age range of 15 to 21 years.

All patients were referred to the department of periodontics for oral prophylaxis (scaling and polishing) and recalled after two weeks. Scores for plaque index (PI), and gingival index (GI), originally given by Silness and Loe,[22] and score for Eastman's interdental bleeding index[23] (EIBI) were obtained by a single evaluator to minimize the bias.

After taking baseline data at T_0, all participants were provided with a similar type of dentifrice (Colgate, Colgate-Palmolive (India) Ltd), manual toothbrushes to Group I and Group II, and power toothbrushes to Group III. Participants of all the groups were given general oral hygiene instructions and demonstrations of brushing techniques were given on a set of plastic models consisting of upper and lower dental arches. Patients were asked to clean their teeth twice daily for 3 minutes in the morning and before going to bed. Interproximal brushes, floss, mouthwashes, and any other chemical or mechanical cleaning aids were not allowed to be used during the research.

During the course of the trial, the text message groups (Group II and Group III) received two text messages per week on their WhatsApp account automatically using a third-party software named SKED which was sent by an orthodontist, whereas no text messages was sent to the control group. Subjects and evaluators (double-blinding) were kept in the dark about their group assignment and were unaware that text messages received by them were part of the study.

For four weeks (a total of eight texts messages) the text messaging groups got messages twice a week as a reminder to practice healthy oral hygiene. After 4 weeks (T_1) all the patients were recalled and scores for plaque index (PI) gingival index (GI), and Eastman's interdental bleeding index (EIBI) were recorded. The gingival index originally was evaluated by a periodontal probe by checking the severity of gingivitis at the mesial, middle and distal gingival margins of the buccal tooth surface, whereas, the plaque index was evaluated by an arch explorer on the mesial, distal, gingival and incisal end of the bracket and their mean values were evaluated.[17] Eastman's interdental bleeding index (EIBI) was recorded 4 times for each interdental papilla and their average score was recorded to determine the bleeding index.[17] The text messages used in this study were: " If you want to keep your smile healthy and attractive, brush your teeth for at least three minutes twice daily. Your smile is the very first thing people notice, so take the time". After the second evaluation at T_1, the text groups continued to receive the message for another 8 weeks twice weekly. After 8 weeks (T_2-T_1), all participants were recalled and a re-evaluation of all the indices was done.

STATISTICAL ANALYSIS

Statistical analysis was performed using Statistical Package for Service Solution, SPSS (Version 21, IBM, Chicago, USA). Shapiro-Wilk test was used to check the distribution of data and found to be normally distributed. Chi-square test of homogeneity was used to check the intergroup variation among males and females, Levene's test was employed to check if samples have equal variances across the age. Paired t-test was used for intragroup comparisons. One-way analysis of variance (ANOVA) was used for intergroup comparison followed by the Tukey Post hoc test. The level of statistical significance was set at $p < 0.05$, and the confidence level at 95%.

RESULT

The chi-square test revealed that there was no statistically significant difference in gender distribution between the groups (Table I).

Table I: Chi-square test for significant difference among male and female between the groups.

	Male	Female	p-value
Group I	14	13	0.705901
Group II	12	15	
Group III	11	16	

*p < 0.05: Statistically significant.

The mean scores of all the three indices for all the study groups with standard deviation are shown in Table II. The mean scores of GI, PI, and EIBI score for all three groups at baseline, 4, and 12 weeks are represented by graphs in Fig 1, Fig 2, and Fig 3 respectively.

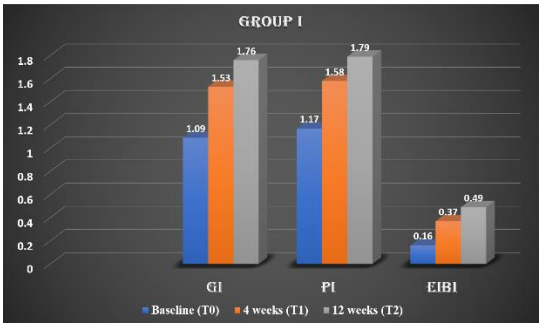

Figure 1

Intragroup comparisons of GI, PI and EIBI scores within each group from baseline (T_0) to 4 weeks (T_1), baseline (T_0) to 12 weeks (T_2), and from 4 weeks (T_1) to 12 weeks (T_2) was done by paired t-test (Table III).

Patients in all the three groups whether they were informed by text messages or not, showed an increase in GI, PI, and EIBI scores from baseline (T_0) to 4 weeks (T_1), a statistically significant difference was found across Group I, whereas Group II and Group III did not show any statistical difference for the same indices.

Table II: Mean scores of all indices in each study group from baseline (T_0) to 4 (T_1) and 12 weeks (T_2)

Indices	Baseline (T_0) mean scores (SD) in mm.	4 weeks (T_1) mean scores (SD) in mm.	12 weeks (T_2) mean scores (SD) in mm.
Group I (Manual brush No reminder message,)			
GI	1.09 (0.22)	1.53 (0.84)	1.76 (0.54)
PI	1.17 (0.31)	1.58 (0.04)	1.79 (0.06)
EIBI	0.16 (0.26)	0.37 (0.12)	0.49 (0.06)
Group II (Manual brush, Text message reminder)			
GI	1.12 (0.18)	1.34 (0.14)	1.45 (0.14)
PI	1.16 (0.23)	1.37(0.12)	1.47 (0.14)
EIBI	0.19 (0.11)	0.34 (0.19)	0.42 (0.16)
Group III (Power brush, Text message reminder)			
GI	1.11 (0.20)	1.39 (0.17)	1.32 (0.17)
PI	1.14 (0.25)	1.36 (0.17)	1.31 (0.15)
EIBI	0.17 (0.16)	0.27 (0.09)	0.22 (0.08)

Note. Mean Gingival index (GI) score, Plaque index (PI) score and Bleeding Index (EIBI) score for Group 1 baseline (T_0), 4 weeks (T_1) and at 12 weeks (T_2). mm (millimeter).

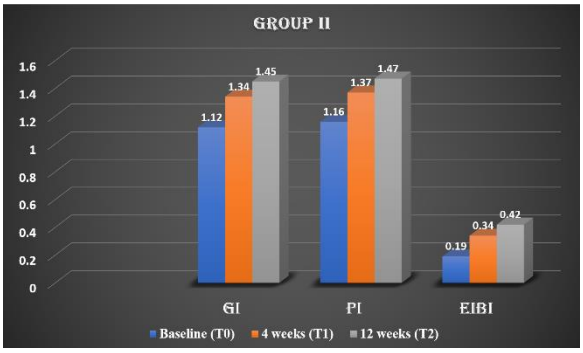

Figure 2

When scores were compared with the paired t-test after a period of 12 weeks (T_0-T_2), all indices (GI, PI, and EIBI) showed a statistically significant difference only for group I. Although group II and group III patients showed an increase in GI, PI, and EIBI it was not statistically significant, suggesting that text message reminder was an effective way of motivating the patients in maintaining oral hygiene. As group II and group III were using regular toothbrushes and power toothbrushes respectively, a less increase in the scores for all indices in group III as compared to group II suggested that power toothbrushes were more efficient in cleaning the teeth and in maintaining a good oral health status when

compared to manual toothbrush even after receiving the reminders.

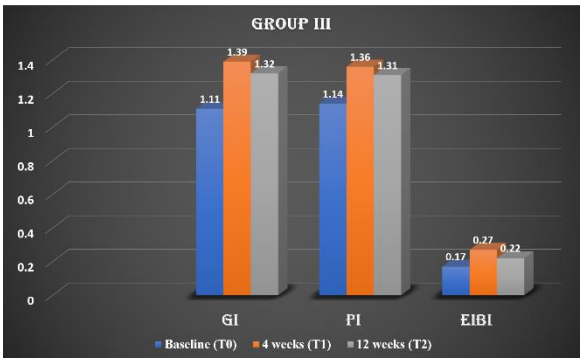

Figure 3

When the difference of mean values of GI, PI, and EIBI between baseline and 4 weeks (T_1-T_0) of three groups were compared by one-way ANOVA followed by the Tukey Post Hoc test, no statistically significant difference for GI, PI, and EIBI was found between any group (Table IV).

Table III: Intragroup comparison for GI, PI and EIBI scores in each study group by paired t-test from baseline (T_0) to 4 weeks (T_1), baseline (T_0) to 12 weeks (T_2), and from 4weeks (T_1) to 12 weeks (T_2).

Intragroup Comparison						
Indices	T_1-T_0	p-value	T_2-T_0	p-value	T_2-T_1	p-value
Group I						
GI	0.44	0.048*	0.67	0.041*	0.23	0.161 NS
PI	0.41	0.044*	0.62	0.039*	0.21	0.099 NS
EIBI	0.21	0.046*	0.33	0.032*	0.12	0.074 NS
Group II						
GI	0.22	0.061 NS	0.33	0.069 NS	0.11	0.084 NS
PI	0.21	0.067 NS	0.31	0.061 NS	0.10	0.075 NS
EIBI	0.15	0.082 NS	0.23	0.053 NS	0.08	0.113 NS
Group III						
GI	0.28	0.051 NS	0.21	0.088 NS	0.07	0.133 NS
PI	0.22	0.059 NS	0.17	0.074 NS	0.05	0.097 NS
EIBI	0.10	0.14 NS	0.05	0.27 NS	0.05	0.29 NS

*p < 0.05: Statistically significant; NS: Non-significant

But on comparing the difference of mean values between baseline and after 12 weeks (T_0 -T_2), a statistically significant difference was found between group I and group II, group I and group III both for GI and PI, and for bleeding index (EIBI) it was statistically significant between-group I and group III only. Moreover, statistically significant differences were observed between group I and group III for all indices (GI, PI, and EIBI) when the differences in their corresponding mean values between 4 weeks (T_1) and 12 weeks (T_2) were compared.

Table IV: one-way ANOVA followed by Tukey Post hoc test with associated p-values.

Intergroup comparisons				
Duration	**Group I (Mean score)**	**Group II (Mean score)**	**Group III (Mean score)**	**p-value**
Gingival index (GI)				
T1-T0	0.44	0.22	0.28	0.116
T2-T0	0.67^{a}	0.33^{b}	0.21^{bc}	0.042^{*}
T2-T1	0.23^{a}	0.11	0.07^{b}	0.028^{*}
Plaque index (PI)				
T1-T0	0.41	0.21	0.22	0.109
T2-T0	0.62^{a}	0.31^{b}	0.17^{bc}	0.039^{*}
T2-T1	0.21^{a}	0.10	0.05^{b}	0.027^{*}
Eastman's interdental bleeding index (EIBI)				
T1-T0	0.21	0.15	0.10	0.158
T2-T0	0.33^{a}	0.23	0.05^{b}	0.046^{*}
T2-T1	0.12^{a}	0.08	0.05^{b}	0.038^{*}

*p < 0.05: Statistically significant. Different letters in a row show significant difference.

DISCUSSION

We clean our teeth for a number of reasons, including to feel refreshed and confident, to have a beautiful smile, to prevent bad breath, and to prevent illness. Personal choice, budget, accessibility, and expert recommendation all play a role in toothbrush selection. Powered toothbrushes may allure to certain people because they offer a more modern, 'high tech' approach to everyday activity.

According to Lang 1973,[24] tooth brushing lowers gingivitis, may prevent periodontitis, and certainly avoids gum bleeding if it is done in combination with motivational text reminders. These advantages apply whether the brush is a manual or motorized power brush.

This study investigated the effects of a text message alert sent straight to patients' WhatsApp accounts on dental hygiene compliance. The GI, PI, and EIBI scales were used to evaluate the outcome. The result of this study showed that motivating orthodontic patients with fixed appliances via text message on their WhatsApp account were an effective way of maintaining good oral hygiene. In this

study, when group II and group III patients were reminded twice weekly over a period of 12 weeks (T_0 -T_2), a significant difference in GI and PI scores were observed between the non-text message group (group I) and text message groups (group II and group III) (Table IV). This study's findings are consistent with those of Eppright et al,[25] who observed that encouraging parents to practice good oral hygiene through text messaging increased compliance. According to Bowen et al,[26] found that sending a text message to the patient for encouraging proper dental care can lower the occurrence of gingivitis, plaque accumulation, and bleeding from gums.

Among the text message groups (Table II), group III had higher GI, PI, and EIBI scores when assessed at 4 weeks (T_1), but was found to have lower scores for the same indices when assessed after the 12 weeks (T_2). This may be due to improper brushing technique and the wrong way of using the power brush by the patient, which they learned to use effectively over time. Lally et al.[27] found that it takes 66 days on average for a behaviour to become an automatic habit. This delay in habit development might explain the cause of the variances in oral hygiene measures at four weeks (T_1) and twelve weeks (T_2) after the baseline (T_0) in-between the text message groups.

Sending a text message is a simple approach for the orthodontist to stay in touch with the patient, especially between sessions. It shows the orthodontist's continued interest in and concern for the patient's welfare. This has been demonstrated to have a significant impact on patient satisfaction and the development of orthodontist-patient relationships.[28] Patients' text messages were originally intended to remind them of appointments, but they may now be used to remind them of things like brushing, wearing elastics, and wearing retainers, among other things. The use of a text message reminder system, such as the one employed in this study, is an effective strategy to improve oral hygiene compliance in orthodontic patients, as well as a unique technique to reach a large number of patients with minimal administrative time.

CONCLUSION

Sending oral hygiene text messages directly to the patient's WhatsApp account is an effective way to encourage them to maintain proper oral hygiene. Compared to manual toothbrushes, plaque can be removed more effectively with powered toothbrushes, reducing the severity of gingivitis and bleeding from the gums.

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How to cite this article: Abrar Md, Goyal M, Kumar M, Kumar S, Yadav E, Madhok S. Effect of Text Messages Regarding Use of Manual Toothbrush and Power Toothbrush in Young Adult Patients with Fixed Orthodontic Appliances on Oral Hygiene Status: A Prospective Study. TMU J Dent 2023; 10(1): 13-20.