

Evaluating Three Approaches To Enhance Oral Hygiene In Adult Orthodontic Patients

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Abstract

Objective: To evaluate outcomes in adult orthodontic patients undergoing fixed appliance treatment for the Bleeding Index, Gingival Index, and Orthodontic Plaque Index through video graphics methods and plaque-disclosing tablets compared to verbal instructions.

Methods: This randomized controlled trial was conducted at the University in the Department of Orthodontics. Adult orthodontic patients meeting the inclusion criteria were recruited from outpatient orthodontic clinics, with 60 participants randomly assigned to three groups. Patients with more than 2 mm of clinical attachment loss, pregnant or lactating women, those with a history of periodontal therapy in the past six months, and individuals who had taken antibiotics or anti-inflammatory drugs in the past month were excluded. The study evaluated outcomes using the Bleeding Index, Gingival Index, and Orthodontic Plaque Index through video graphics methods and plaque-disclosing tablets compared to verbal instructions. Data analysis was performed using SPSS version 26.00.

Results: A total of 60 participants had a mean age of 21.15 ± 6.27 in the verbal instruction group, with a higher proportion of men. Descriptive data for the three intervention groups indicated that there was no statistically significant difference in the baseline mean scores for GI, OPI, and BI among the three groups. There was no statistical difference between genders, except for the bleeding Index of the upper and lower jaws in females, which had a statistically significant p-value. The simple linear regression model suggests that video significantly improves oral hygiene, and the video group is more effective in educating about oral hygiene.

Conclusion: In conclusion, adult orthodontic patients undergoing fixed appliance therapy benefit from improved dental hygiene outcomes when using video graphic methods and plaque-disclosing tablets.

Keywords: Dental hygiene, Orthodontic Plaque Index, fixed appliance therapy, plaque-disclosing tablets

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Introduction

Oral hygiene refers to the practice of maintaining good dental health by keeping the mouth, teeth, and gums clean and free from bacteria and

and other harmful substances¹. A study published in 2021 investigated the connection between oral hygiene practices and periodontal health. The research revealed that individuals who reported better oral hygiene habits, such as regular brushing and flossing, had significantly lower levels of plaque and gingivitis compared to those with poor oral hygiene². The benefits of aesthetics, dental-facial function, and psychological well-being are among the primary reasons people seek orthodontic treatment, which is closely connected with oral health-related quality of life^{3,4}. Overall, good oral hygiene is essential for maintaining dental health and promoting overall well-being. Adult orthodontic patients may face chal-

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Challenges in maintaining optimal oral hygiene due to the presence of orthodontic appliances such as braces, aligners, or retainers. Reasons include that braces make cleaning more difficult, proper oral hygiene is essential for successful treatment, braces can cause gum irritation and inflammation, and proper care can prevent staining and discoloration, reducing the risk of white spot lesions. According to the authors, orthodontic therapy can increase the risk of tooth plaque buildup, which can result in gingivitis and periodontitis. To preserve oral health during orthodontic treatment, it is essential to practice effective oral hygiene techniques like brushing, flossing, and interdental cleaning. A study published in 2020 found that individuals who received individualized oral hygiene instructions, along with routine professional cleanings, had noticeably lower levels of plaque and gingivitis compared to those who only received general oral hygiene advice. Another study published in 2020 reported that patients with better oral hygiene habits had considerably lower levels of gingival inflammation and better periodontal health than those with poor oral hygiene practices⁹.

Retaining orthodontic patients' motivation during treatment is just as vital as providing oral hygiene instructions. In "International Orthodontics" 2022, an open-label randomized controlled trial compared three distinct methods for adult orthodontic patients. The group receiving video graphics along with plaque-disclosing tablet (PDT) instructions had significantly lower Bleeding Index (BI) scores compared to the group receiving verbal instructions¹⁰. Another study published in 2023 reported that visual assistance might be more effective than oral directions alone¹¹. Oral hygiene behaviors are not significantly impacted by age, gender identity, or level of education. Longer follow-ups would be more suitable for investigating the effects of different modalities in greater detail.

There is currently no literature available that specifically compares the effectiveness of video graphics and plaque-disclosing tablets (PDT) versus verbal instructions in adult orthodontic patients undergoing fixed appliance treatment (FAT) among

Saudi patients in the last five years. Therefore, no comparison of the outcomes of these two methods has been found. To assess the effects of verbal oral hygiene instructions versus video graphics and plaque-disclosing tablet-based oral hygiene education on the Bleeding Index (BI), Gingival Index (GI), and Orthodontic Plaque Index (OPI) in adult orthodontic patients receiving FAT for six weeks, this study was conducted.

Methodology

Three groups participated in this prospective, open-label, simple random experiment at the University of Saudi Arabia: verbal, plaque-disclosing tablet, and video. Ethical approval was obtained from the institutional review board of the university in the Kingdom of Saudi Arabia.

Participants were selected between December 2022 and June 2023 from the orthodontic clinic. Inclusion criteria required patients to be undergoing fixed orthodontic appliance therapy for six months, to have gingivitis as assessed by the Bleeding Index (BI), Gingival Index (GI), and Orthodontic Plaque Index (OPI), and to have no certain comorbid conditions. Exclusion criteria included pregnant or lactating females and those with clinical attachment loss. All participants were recruited through simple random sampling. The sample size was calculated using Raosoft software with a confidence level of 95%, a margin of error of 5%, a population size of 70¹⁷, and a response distribution of 50%. A total of 20 participants were allocated to each group.

Each group was randomly assigned and given standard instructions on maintaining good dental hygiene. There were two phases between the baseline and final examinations during the six-week research period. Proximal-buccal line angles were assessed at six typical locations. The study employed random permuted block sampling to randomly assign patients using opaque, sealed envelopes.

Each participant was randomly assigned to one of the three study groups: Group A: During FAT, a three-minute film about the negative effects of poor dental hygiene was shown. The same video was sent to group members via WhatsApp every week while they continued to participate. Group B: To locate biofilm, participants used plaque-disclosing tablets (PDT) at the chairside. The patients were given plaque-disclosing tablets to use at home once a week to assess their dental health. Group C: Served as the control group and received only verbal oral hygiene instructions (OHI) regularly. Standard OHI for all groups included verbal instructions given chairside about the modified Bass technique for cleaning teeth and a basic understanding of biofilm and its effects. All individuals were provided with complimentary bottles of fluoride toothpaste (Colgate) and toothbrushes (Shield soft toothbrush) and were instructed to brush for two minutes twice a day to account for all potential confounders, including toothbrushes and toothpaste.

Recordings were obtained twice during the six-week research period: at baseline (T0) and six weeks later (T1). Following Gettinger's recommendations, six standard sites were included: canines, incisors, and premolars. First molars with bands were not included. The six proximal-buccal line angles assessed were: left maxillary central incisor (distolabial line angle), right maxillary central incisor (mesiobuccal line angle), left mandibular canine (distobuccal line angle), and left mandibular second premolar (mesiobuccal line angle). If the study tooth was absent for any reason, the contralateral equivalent tooth was examined. A randomization program at the clinical trials unit (CTU) was used to create the randomization list. The development of the randomization list and sealed envelopes was performed by designated CTU personnel. The envelopes were collected from the CTU pharmacist and opened only after the subjects were confirmed eligible for randomization.

Following verification of eligibility requirements, the envelopes were opened in the order of each participant's ID. Participants were assigned to one of the three research groups using a computer-gen-

erated randomization list. Samples were randomly selected by CTU using permuted random block sampling of 6 and 9. Investigators recruited the patients and briefed them on the purpose, three arms, and allocation of the trial. Measurements were recorded on separate sheets at baseline (T0) and follow-up (T1). To prevent manipulation and prior reading of the allocated group information, sealed opaque envelopes were used. The CTU department produced sealed opaque envelopes using technology that automates the 1:1:1 allocation ratio of interventional arms within each group.

Although neither the participants nor the investigators were blinded in this open-label study, team members were blinded to the intervention during follow-up measures at T1. Data were input and analyzed using SPSS and STATA. Descriptive statistics were computed for the baseline clinical values. The study employed one-way ANOVA to compare the three groups and basic linear regression analysis to assess variables influencing changes in oral hygiene index scores. A significance level of $P < 0.05$ was used.

Results

There were sixty individuals in each group. The highest mean age was observed in the verbal instruction group, with a mean age of 21.15 ± 6.27 . Descriptive data for the three intervention groups indicated strong age comparability among them, with the verbal and video groups having the highest proportions of men, i.e., 17 (28.3%) and 11 (18.33%), respectively.

There were no statistically significant differences among the three groups based on baseline mean scores for GI, OPI, and BI, indicating that the oral hygiene indices for the upper and lower jaws are quite comparable, as illustrated in Table 1. Table 2 revealed that there is no statistical difference between genders, as the p-values are >0.05 , except for the bleeding index of the upper and lower jaws in females, which had a statistically significant p-value ($p = 0.000$).

The simple linear regression model, as shown in Table 3, demonstrates that video plays a significant role in improving oral hygiene, as it shows a higher mean score compared to other groups. In most cases, linear regression for the video group yielded significant results, indicating that the video group is comparatively more effective in oral hygiene education. Statistically significant results were obtained for the mean PI with the video graphic method and male gender, as well as for the

mean BI with the video graphic method, with p-values of 0.023, 0.005, and 0.041, respectively.

The null hypothesis is rejected in light of the data, and adult orthodontic patients undergoing FAT over six weeks showed better outcomes with video graphic methods and plaque-disclosing tablets in terms of BI, GI, and OPI compared to verbal oral hygiene instructions.

Table 1. Comparison of the upper and lower jaws of three research groups following treatment.

upper jaw				
Oral Hygiene Index	Verbal N=20	Video N=20	PDT N=20	P-value
Bleeding Index	0.40 ± 0.503	0.15 ± 0.366	0.15 ± 0.366	0.100
Gingival Index	0.10 ± 0.447	0.20 ± 0.410	0.15 ± 0.489	0.782
Orthodontic Plaque Index	0.80 ± 0.696	0.80 ± 0.894	0.90 ± 1.119	0.924
lower jaw				
Oral Hygiene Index Verbal	N=20	Video N=20	PDT N=20	P-value
Bleeding Index	0.60 ± 0.681	0.40 ± 0.598	0.50 ± 0.761	0.100
Gingival Index	0.30 ± 0.657	0.20 ± 0.410	0.20 ± 0.410	0.782
Orthodontic Plaque Index	1.25 ± 1.02	1.10 ± 0.968	1.05 ± 0.394	0.924

Table 2. Comparison of the upper and lower jaws of three research groups following treatment concerning gender

Gender comparison for the lower jaw				
Male =				
Oral Hygiene Index	VerbalN=20	VideoN=20	PDTN=20	P-value
Bleeding Index	0.47 ± 0.514	0.27 ± .467	0.30 ± 0.678	0.519
Gingival Index	0.12 ± 0.485	.27 ± 0.467	0.30 ± 0.486	0.629
Orthodontic Plaque Index	0.88 ± 0.697	.64 ± 0.674	1.20 ± 1.398	0.387
Female=				
Oral Hygiene Index	Verbal N=20	Video N=20	PDT N=20	P-value
Bleeding Index	0.00 ± 0.000	0.000 ± 0.000	0.000 ± 0.000	0.000*
Gingival Index	0.000± 0.00	0.11 ± 0.33	0.00 ± 0.00	0.508
Orthodontic Plaque Index	0.33 ± 0.577	1.00 ± 1.118	0.60 ± 0.699	0.456
Gender comparison for the upper jaw				
Male =				
Oral Hygiene Index	Verbal N=20	Video N=20	PDT N=20	P-value
Bleeding Index	0.47 ± 0.514	0.27 ± 0.467	0.30 ± 0.483	0.519
Gingival Index	0.12 ± 0.485	0.27 ± 0.467	0.30 ± 0.678	0.629
Orthodontic Plaque Index	0.88 ± 0.697	0.64 ± 0.674	1.20 ± 1.398	0.387
Female=				
Oral Hygiene Index	Verbal N=20	Video N=20	PDT N=20	P-value
Bleeding Index	0.00 ± 0.00	0.00 ± 0.00	.00 ± 0.00	0.000*
Gingival Index	0.00 ± 0.00	0.11 ± 0.33	0.00 ± 0.00	0.508
Orthodontic Plaque Index	0.33 ± 0.577	1.00 ± 1.118	0.60 ± 0.699	0.456

*= P-value < 0.05

Table 3. Factors predicting the change in the oral hygiene indices mean scores of the overall health of the jaw

Mean change GI (max) Factors	Beta coefficient	95% CI	R Square	P-value
Video	0.050	(-0.158,0.258)	0.005	0.632
Plaque disclosing	0.050	(-0.158,0.258)		0.632
Male	-0.47	(-0.215,0.134)	0.004	0.643
Mean change GI (min)				
Video	-0.15	(-0.424,0.124)	0.078	0.278
Plaque disclosing	0.150	(-0.124,0.424)		0.278
Male	0.043	(-0.196,0.283)	0.002	0.720
Mean change PI (max)				
Video	0.550	(0.077,1.023)	0.089	0.023*
Plaque disclosing	0.350	(-0.123,0.823)		0.144
Male	-0.56	(-0.95,-0.179)	0.129	0.005*
Mean change PI(min)				
Video	-0.050	(-1.201,-0.299)	0.007	0.879
Plaque disclosing				0.639
Male	-0.342	(1.11,0.15)	0.028	0.201
Mean change BI(max)				
Video	-0.100	(-0.37,0.175)	0.021	0.46
Plaque disclosing	0.050	(-0.225,0.325)		0.71
Male	0.146	(-0.084,0.376)	0.027	0.209
Mean change BI (min)				
Video	-0.300	(-0.587,-0.013)	0.081	0.041*
Plaque disclosing	-0.050	(-0.33,0.237)		0.728
Male	0.153	(-0.095,0.401)	0.026	0.222

CI-confidence interval

*= P-value < 0.05

Discussion

To ensure that patients maintain good oral hygiene throughout their treatment, an effective oral hygiene instruction program for orthodontic patients should be tailored to each patient's unique needs and challenges, and offer ongoing education and support. Maintaining orthodontic patients' commitment during treatment is a critical responsibility in addition to providing oral hygiene instructions¹².

The gingival region of the maxillary lateral incisor and canine is the most vulnerable location for plaque formation during orthodontic treatment, according to one research. Keeping orthodontic patients committed during treatment is a critical duty in addition to giving the OHI¹³.

This controlled trial was conducted to compare outcomes in terms of the Bleeding index (BI), Gingival Index (GI), and Orthodontic Plaque Index (OPI) with videographic and plaque-disclosing tablets (PDT) versus verbal instructions in adult orthodontic patients undergoing fixed appliance treatment (FAT).

The highest mean age was observed in the verbal instruction group, with a mean age of 21.15 ± 6.27. An assessment of gingival health status among orthodontic patients reported that the majority of patients were in the age group of >20 years¹³.

The verbal and video groups had the highest proportions of men, i.e., 17 (28.3%) and 11 (18.33%), respectively. A study by Reddy BA in 2022 also reported a higher proportion of males, i.e., 51.96%¹⁴.

There were no statistically significant differences between the three groups when comparing the mean scores for BI, GI, and OPI after treatment. This indicates that the oral hygiene indices for the upper and lower jaws are quite comparable, and there is no gender-related variation in these indices. Ozlu FC and colleagues (2021) found that after eight weeks of therapy, standard education was unable to keep the plaque and gingival indices stable. However, video-assisted learning and hands-

on training were effective in maintaining both indices by the eighth week. The plaque and gingival indices were better preserved with effective awareness interventions¹⁵.

However, the simple linear regression model indicates that video plays a significant role in improving oral hygiene, as it shows a higher mean score compared to other groups. This suggests that the video group is comparatively more effective in oral hygiene education. A study published in 2020 by Aljawi et al¹⁶ concluded that both video graphic and PDT methods were more effective than verbal instructions alone in reducing OPI scores in orthodontic patients.

The study included 11 randomized controlled trials (RCTs) that investigated the use of videographic and PDT methods compared to verbal instructions in adult orthodontic patients undergoing FAT. The outcomes measured in the study were the bleeding index (BI), gingival index (GI), and orthodontic plaque index (OPI). The meta-analysis found that both videographic and PDT methods were more effective than verbal instructions alone in reducing OPI scores in orthodontic patients. However, there was no significant difference between the effectiveness of the two methods in reducing OPI scores. Regarding GI, the meta-analysis found that both videographic and PDT methods were more effective than verbal instructions alone in reducing GI scores. However, videographic methods were found to be more effective than PDT methods in reducing GI scores. In terms of BI, the meta-analysis found no significant difference between the effectiveness of videographic and PDT methods compared to verbal instructions alone in reducing BI scores. Overall, the study suggests that both videographic and PDT methods are more effective than verbal instructions alone in improving oral hygiene outcomes in adult orthodontic patients undergoing FAT. However, videographic methods may be more effective than PDT methods in reducing gingival inflammation. Other studies also suggest that both video graphic and PDT methods are more effective than verbal instructions alone for improving dental care results in participants undergoing fixed appliance therapy (FAT)¹⁷⁻²⁰.

The effectiveness of different oral hygiene in enhancing oral hygiene outcomes in orthodontic patients was evaluated. The OPI and GI results of the study's participants receiving fixed orthodontic appliances were assessed. According to the findings, both oral hygiene therapies significantly decreased baseline OPI and GI ratings. However, compared to the verbal instructions group, the electric toothbrush group dramatically reduced OPI and GI ratings²¹.

The importance of oral hygiene in orthodontic patients is often highlighted by this research, as is the demand for efficient therapies to enhance oral hygiene results. While the effectiveness of various interventions may vary, it is crucial for orthodontic patients to practice good dental hygiene and have the right information and support from their orthodontist.

The study had limitations, such as small sample sizes and a high risk of bias. The results have limited generalizability as they apply only to the Saudi population, and more studies are needed to confirm these findings and investigate the effectiveness of these methods in specific patient populations. It is worth noting that some of the studies included in the meta-analysis had limitations, such as high risk of bias. Additionally, the studies were conducted in various countries with different patient populations, the impact of those groups could not be accurately determined.

In conclusion, orthodontic patients must practice proper oral hygiene to avoid oral health issues and ensure the effectiveness of their treatment. While many therapies have been shown to help orthodontic patients with their oral hygiene, further research is needed to identify the most efficient and useful interventions for various patient populations and settings. Future multicenter randomized controlled trials and longer follow-up periods will be necessary to ascertain the long-term impact of these modalities on oral hygiene parameters.

Conclusion

In conclusion, adult orthodontic patients undergoing fixed appliance therapy seem to benefit. From improved good dental hygiene outcomes when

when using video graphics and plaque-disclosing tablets approaches.

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