

Oral hygiene condition in orthodontic patients treated with fixed appliance

Ali A. Jassim¹^{*}, Mehdi A. Alrubayee², Shakeel Kazmi³

¹Postgraduate Student, Department of Orthodontics, College of Dentistry, University of Baghdad, Baghdad, Iraq.

²Assistant Professor of Orthodontics, Department of Orthodontics, College of Dentistry, University of Baghdad, Baghdad, Iraq.

³Associate Professor of Orthodontics, Department of Orthodontics, College of Dentistry, University of Shaheed Zulfikar Ali Bhutto, Islamabad.

*Corresponding Author: Ali A. Jassim

DOI: <https://doi.org/10.55145/ajbms.2024.03.01.003>

Received July 2023; Accepted September 2023; Available online November 2023

ABSTRACT: Oral hygiene is the cornerstone of good oral health especially in patients with fixed orthodontic appliances where the appliances make it challenging to practice normal oral hygiene. The objective of this study was to evaluate oral hygiene and gingival health in patients undergoing fixed orthodontic treatment at four different time points, with repeated oral hygiene guidance provided during each visit. In this prospective study, 41 patients between the ages of 18 and 22 were divided into two groups, one of which had just begun fixed orthodontic treatment (New) and the other have passed five months from the beginning of the treatment (Old). All patients got traditional oral hygiene training with oral hygiene kit and (SENSODYNE) toothpaste. The plaque index (PI) and marginal bleeding index (MBI) were measured. Both groups showed increase in plaque values without statistical differences. Whereas BI showed statistical differences ($P=0.010$) at New group only after 4 weeks. We think that oral hygiene enforcement at each visit not enough to improve oral hygiene status and need to seek for other strategies to enhance oral health like using software reminders.

Keywords: Oral hygiene, orthodontics



1. INTRODUCTION

Oral hygiene of utmost importance in maintaining good oral health, particularly in individuals with fixed orthodontic appliances. These appliances can pose challenges for regular oral care practices [1, 2, 3] as shown a notable decline in oral hygiene shortly after the initial bonding of these appliances, followed by gradual improvement by the fifth month of treatment [4]. However, some studies have indicated that oral hygiene problems are highest towards the end of orthodontic treatment [5].

These appliances like brackets, tubes, band material, ligating materials and arch-wires are liable for microbial adhesion and create new retentive areas for dental biofilm (plaque) and debris [6] leading to elevate the presence of cariogenic bacteria like *Streptococcus mutans* that result in acid production causing tooth demineralization [7], and increase the incidence of gingivitis [8, 9, 10]. Because of these adverse effects, 5-10% of patients might discontinue or even termination of treatment [11, 12, 13].

Therefore, orthodontic patients should pay attention to their diet, avoiding sugary and sticky foods that can lead to dental problems. In addition, routine dental check-ups and professional cleanings are vital for monitoring and maintaining oral health throughout the treatment period [14].

The objective of this study was to evaluate oral hygiene and gingival health in patients undergoing fixed orthodontic treatment at four different time points, with repeated oral hygiene instructions provided during each visit.

*Corresponding author: ali.abdulkadim1203a@codental.uobaghdad.edu.iq
<http://journal.alsalam.edu.iq/index.php/ajbms>

2. MATERIALS AND METHOD

a) Subjects and settings

This longitudinal prospective study was conducted in Orthodontic Clinic at Al-Shamyia Specialized Center in Thi-qar. Participants for this study included patients with fixed orthodontic appliance according to the following criteria.

Inclusion criteria:

- I. Patients with age between 18 and 22 years who received their orthodontic appliances with the starting of the study and patients that had passed 5th month of orthodontic treatment.
- II. All anterior teeth are present without missing any tooth such as lateral incisor or missing cases.
- III. Subjects should talk and read Arabic language.

Exclusion Criteria:

- I. Patients with mental and physical disability or craniofacial disorders.
- II. Patients with enamel or dentin dysplasia.
- III. Patients that taking medications affecting plaque accumulation such as antibiotics or antibacterial mouth rinses.
- IV. Patients with periodontal disease.
- V. Patients with first premolar extraction cases.

b) Sample size

The sample size was taken according to Farhadifard *et al.* [15] results. Using the mean values of the two groups with their standard deviations, a total of a minimum 14 patients were needed per group to yield an Alfa value of 0.05 with a study power of 80%. In this study a total of 41 patients were distributed into two groups.

c) Treatment protocol

The sample was divided into two groups, one group (21 person) was starting orthodontic treatment with the starting of the study (called New), and the other (20 person) was at 5th month from the starting of the orthodontic treatment (called Old). Only New group participant were recalled after one week after insertion the appliances for recording the scores to give time for plaque formation and gingival irritation [16]. All groups received oral hygiene instructions, toothpaste (SENSODYNE), oral hygiene kit at the baseline (T0) with repeated the instructions at each visit.

- The oral hygiene instructions that recommended by the British Orthodontic Society were the times of brushing a day that recommended at least to brush twice a day, using the dental floss at least once a day, using fluoridated tooth paste (SENSODYNE) and avoid sticky and sugary foods [17]. The method of brushing was the Charter's technique (small, circular shaking motions, with the brush is held at a 45 degree angle to the tooth long axis) that is specifically indicated for patients with orthodontic and prosthodontic appliances [18].
- The study outcomes are the amount of plaque and the total number of gingival bleeding sites in the incisors, canines and first premolars of the maxilla and mandible as dental lesions affect anterior teeth especially lateral incisors more than posterior teeth [19].
- Al-Anezi and Harradine plaque index (a modification to Silness and loe plaque Index) was used since most orthodontic trials employed the original Silness and Loe Plaque Index because of its simplicity. The limitation of the original index was it follows the usual pattern of plaque collection and development in the absence of orthodontic bracket. The buccal surfaces of these teeth were sectioned into four areas (mesial, distal, gingival and incisal) depending on the orthodontic bracket for plaque measurements. Each of the four buccal tooth sites were received a score between 0 and 3 (TABLE 1) [20].

Table 1. - Plaque index measurements

Score	Clinical Appearance
0	No plaque.
1	Denoting the absence of visible dental plaque but the accumulation of soft deposits on a probe used to clean the surface.
2	Denoting a modest buildup of soft deposits visible to the bare eye on the tooth.
3	Denoting a plenty of soft deposits visible on the tooth.

While the gingival bleeding will be assessed by using the Marginal Bleeding Index by angling a probe toward the tooth's longitudinal axis by roughly 60 degrees as moving along the marginal gingiva. When there was bleeding, a score of (1) was assigned; otherwise, a score of (0) was assigned. The buccal aspects were evaluated at the mesio-buccal, buccal, and disto-buccal locations. Marginal probing provided a more accurate assessment of a healthy gingival condition in contrast to the probing the button of the pocket with its false positive outcomes [21].

d) Statistical analysis

The statistical package for social sciences software (SPSS Inc., version 26, Chicago, Illinois, USA) was used to carry out the statistical procedures. Data were analyzed through parametric tests including:

1. Descriptive statistics:
 - Mean
 - Standard deviation (SD).
 - Tables and figures.
2. Inferential statistics:
 - Paired sample t-test.

In the statistical evaluation, the following levels of significance were used according to probability value (p-value):
 $P > 0.05$ Non-significant (NS)
 $0.05 \geq p > 0.01$ * Significant
 $0.01 \geq p > 0.001$ ** highly significant

3. RESULTS

3.1 Gender

Regarding gender distribution, it was found that more females were participated in the study than males (FIGURE 1).

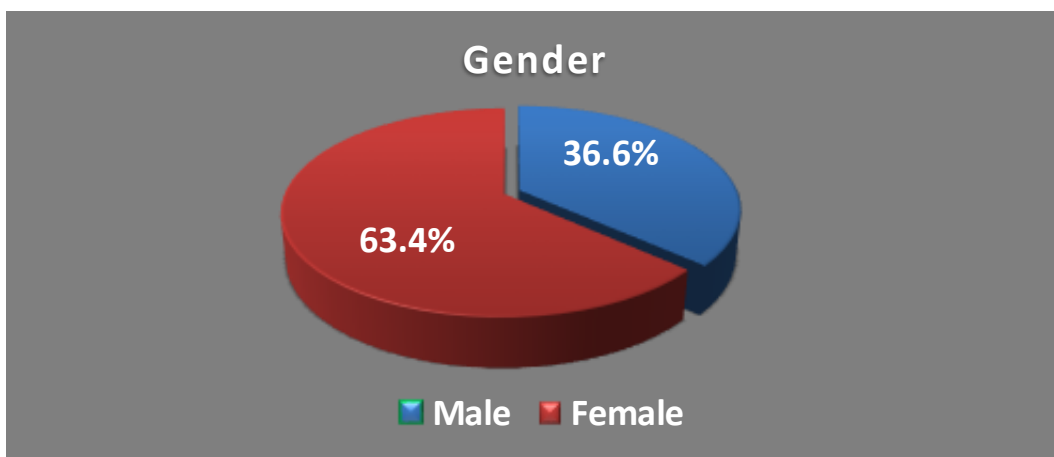


FIGURE 1. - Distribution of the studied patients according to gender

3.2 FOLLOW UP OF PLAQUE INDEX

3.2.1 NEW GROUP

The comparison of the mean plaque index of the New control group at baseline, after 4, 8 and 12 weeks of treatment showed no significant increase in the mean plaque index throughout the study period (TABLE 2).

Table 2. - Comparison in the plaque index of New group throughout the study period

New Control Group	Plaque Index Mean \pm SD	Paired t-test	P- Value*
Baseline	0.46 \pm 0.28		0.540
After 4 Weeks	0.52 \pm 0.39	- 0.624	NS
Baseline	0.46 \pm 0.28		0.233
After 8 Weeks	0.57 \pm 0.30	- 1.230	NS
Baseline	0.46 \pm 0.28		0.299
After 12 Weeks	0.56 \pm 0.31	- 1.066	NS

3.2.2 OLD GROUP

Also in this group, the mean plaque index after 8 and 12 weeks of orthodontic treatment was not significantly reduced from that at baseline (TABLE 3).

Table 3.- Comparison in the plaque index of Old control group throughout the study period

Old Control Group	Plaque Index Mean ± SD	Paired t-test	P- Value*
Baseline	0.97 ± 0.44	- 0.314	0.757
After 4 Weeks	1.01 ± 0.58		NS
Baseline	0.97 ± 0.44	0.520	0.609
After 8 Weeks	0.94 ± 0.50		NS
Baseline	0.97 ± 0.44	1.630	0.120
After 12 Weeks	0.85 ± 0.48		NS

3.3 FOLLOW UP OF GINGIVAL BLEEDING INDEX

3.3.1 NEW GROUP

In this group, the mean bleeding index significantly increased after 4 weeks compared to that at baseline (P= 0.010). No significant difference was detected after 8 and 12 weeks of treatment (TABLE4).

Table 4.- Comparison in the bleeding index of New control group throughout the study period

New Control Group	Gingival Bleeding Index Mean ± SD	Paired t-test	P- Value*
Baseline	0.018 ± 0.035	- 2.828	0.010
After 4 Weeks	0.035 ± 0.017		S
Baseline	0.018 ± 0.035	- 2.547	0.206
After 8 Weeks	0.025 ± 0.016		NS
Baseline	0.018 ± 0.035	- 0.892	0.383
After 12 Weeks	0.024 ± 0.012		NS

3.3.2 OLD GROUP

In this group, the mean bleeding index was not significantly different after 4, 8 and 12 weeks than that at baseline (TABLE 5).

Table 5.- Comparison in the bleeding index of Old control group throughout the study period

Old Control Group	Gingival Bleeding Index Mean ± SD	Paired t-test	P- Value*
Baseline	0.11 ± 0.06	1.354	0.192
After 4 Weeks	0.10 ± 0.07		NS
Baseline	0.11 ± 0.06	0.352	0.729
After 8 Weeks	0.11 ± 0.04		NS
Baseline	0.11 ± 0.06	2.118	0.056
After 12 Weeks	± 0.05 0.09		NS

4. DISCUSSION

4.1 GENDER

In terms of gender distribution in this study, the number of females was more than males participated, this could be explained that more females search for orthodontic care in all age groups excluding 40 and older [22].

4.2 PLAQUE SCORES

In the present study, the mean plaque values of New group showed slight increase over time without significant differences, as it was found at evidence-based studies that an initial period of one month following braces installment is a challenging period for patients [23, 24]. In addition, these results are similar to a recent study that found that there

was on significant increase in plaque index after 3 months of orthodontic treatment compared to that before treatment [25].

While the Old group showed a reduce in plaque means again without significant differences that was consistent with a study shown a decline in plaque values by the fifth month of orthodontic treatment [12]. In contrast to Migliorati et al. [26] who revealed that plaque accumulation and its consequence to gingival inflammation rises during active stage of orthodontic treatment demonstrating the increased complexity of the therapy.

4.3 BLEEDING SCORES

The New group showed a significant increase of the bleeding values after 4 weeks ($p=0.010$). This result is in agreement with a study found that patients with fixed orthodontic appliances had significant increase in the mean value of bleeding on probing scores after 4 weeks [27], while other study showed this parameter increased at the initial stage of treatment (first month) but without statistically significant difference from baseline [28].

While for the other (Old) group, they showed no statistical difference in bleeding mean scores that is covenant with Eppright et al. [29] who found no statistical differences within the control group while the text message group as a reminder for oral care, there was significant change in bleeding and plaque indices over time.

5. LIMITATION OF THE STUDY

- Limited age range that was available in the research center.
- The study was not multicenter as it conducted only at Al-Shamyia Specialized Center in Thi-qar.
- The complexity of the orthodontic treatment was not taken into account.

6. CONCLUSION

In conclusion, the relying solely on oral hygiene instruction may not be sufficient to improve oral hygiene, indicating the need for additional methods or approaches to achieve better results in maintaining oral health such as smartphone reminders.

Funding

None

ACKNOWLEDGEMENT

The authors would like to thank the anonymous reviewers for their efforts.

CONFLICTS OF INTEREST

The authors declare no conflict of interest

REFERENCES

- [1] H. R. Abdulbaqi, A. A. Abdulkareem, M. L. Alshami and M. R. Milwa, "The oral health and periodontal diseases awareness and knowledge in the Iraqi population. Online-based survey," *Clinical and Experimental Dental Research*, vol. 6, no. 5, pp. 519-528, 2020.
- [2] B. U. Zachrisson, "Oral hygiene for orthodontic patients: current concepts and practical advice," *American journal of orthodontics*, vol. 66, no. 5, pp. 487-497, 1974.
- [3] AM. Bollen, J. Cunha-Cruz, D. W. Bakko, G. J. Huang and P. P. Hujoel, "The Effects of orthodontic therapy on periodontal health," *The Journal of the American Dental Association*, vol. 139, no. 4, pp. 413-422, 2008.
- [4] T. S. Al-Jewair, S. Suri and B. D. Tompson, "Predictors of adolescent compliance with oral hygiene instructions during two-arch multibracket fixed orthodontic treatment," *The Angle Orthodontist*, vol. 81, no. 3, pp. 525-531, 2011.
- [5] K. Cantekin, M. Celikoglu, M. Karadas, H. and A. Yildirim and Erdem, "Effects of orthodontic treatment with fixed appliances on oral health status: A comprehensive study," *Journal of dental science*, vol. 6, no. 4, pp. 235-238, 2011.
- [6] H. S. Saad, G. H. Nidhal and A. G. B. Hassan, "Evaluation of microbial contamination of different orthodontic as received arch wires from manufacturers," *International Journal of Medical Research & Health Sciences*, vol. 6, no.12, pp. 13-18, 2017.
- [7] M. J. Al-Duliamy, "In vivo plaque count of Streptococcus Mutans around orthodontic brackets bonded with two different adhesives," *Journal of Baghdad College of Dentistry*, vol. 26, no. 4, pp. 175-179, 2014.
- [8] D. Hussein, B. Hussein and M. Abdul-Rahman, "Effect of tooth brushing technique on oral hygiene in patients with fixed orthodontic appliances," *Journal of baghdad college of dentistry*, vol. 17, no. 1, 2005.
- [9] R. G. Rosenbloom and N. Tinanoff, "Salivary Streptococcus mutans levels in patients before, during, and after orthodontic treatment," *American Journal of Orthodontics and Dentofacial Orthopedics*, vol. 100, no. 1, pp. 35-37, 1991.

- [10] E. Lara-Carrillo, NM. Montiel-Bastida, L. Sánchez-Pérez and J. Alanís-Tavira, "Effect of orthodontic treatment on saliva, plaque and the levels of Streptococcus mutans and Lactobacillus," *Medicina Oral Patología Oral y Cirugía Bucal*, vol. 15, no. 6, pp. 924-929, 2010.
- [11] S. Sanpei, T. Endo and S. Shimooka, "Caries risk factors in children under treatment with sectional brackets," *Angle Orthodontist*, vol. 80, pp. 509-514, 2010.
- [12] T. Mehra, R. S. Nanda and P. K. Sinha, "Orthodontists' Assessment and management of patient compliance," *The Angle Orthodontist*, vol. 68, no. 2, pp. 115-122, 1998.
- [13] A. Derks, A. M. Kuijpers-Jagtman, J. E. Frencken, M. A. Van't Hof and C. Katsaros, "Caries preventive measures used in orthodontic practices: an evidence-based decision," *American Journal of Orthodontics and Dentofacial Orthopedics*, vol. 132, no. 2, pp. 165-70, 2007.
- [14] H. A. Kiyak, "Does orthodontic treatment affect patients' quality of life?," *Journal of dental education*, vol. 72, no. 8, pp. 886-894, 2008.
- [15] H. Farhadifard, S. Soheilifar, M. Farhadian, H. Kokabi and Bakhshaei, "Orthodontic patients' oral hygiene compliance by utilizing a smartphone application (Brush DJ): a randomized clinical trial," *BDJ open*, vol. 6, no. 1, pp. 1-6., 2020.
- [16] B. D. EDEN, "Prevention strategies for periodontal diseases," *Prevention in Clinical Oral Health Care*, pp. 213-229, 2008.
- [17] S. R. Aljohani and D. H. Alsaggaf, "Adherence to dietary advice and oral hygiene practices among orthodontic patients," *Patient preference and adherence*, pp. 1991-2000, 2020.
- [18] J. S. Suhasini, and M. Valiathan, "Brushing techniques," *European Journal of Molecular and Clinical Medicine*, vol. 7, no. 2, pp. 6601-6611, 2020.
- [19] M. Khoroushi and M. Kachuie, "Prevention and treatment of white spot lesions in orthodontic patients," *Contemporary clinical dentistry*, vol. 8, no. 1, pp. 11, 2017.
- [20] S. A. Al-Anezi and N. W. Harradine, "Quantifying plaque during orthodontic treatment," *The Angle Orthodontist*, vol. 82, no. 4, pp. 748-753, 2012.
- [21] M. A. B. Rebelo and A. C. D. Queiroz, "Gingival indices: state of art," Panagakos FS, Davies RM. *Gingival Diseases-Their Aetiology, Prevention and Treatment*. London: IntechOpen Limited, pp. 41-54, 2011.
- [22] B. Wędrychowska-Szulc and M. Syryńska, "Patient and parent motivation for orthodontic treatment—a questionnaire study," *The European Journal of Orthodontics*, vol. 32, no. 4, pp. 447-452, 2010.
- [23] F. Firth, F. Bennani, S. Stacknik and M. Farella, "Orthodontic patient co-operation: a review of the clinician's role in predicting and improving patient compliance," *Australasian Orthodontic Journal*, vol. 35, no. 1, pp. 5-12, 2019.
- [24] S. Patil, I. A. Hedad, A. A. Jafer, G. K. Abutaleb, T. M. Arishi, S. A. Arishi, H. A. Arishi, M. Jafer, A. N. Gujar, S. Khan and A. T. Raj, "Effectiveness of mobile phone applications in improving oral hygiene care and outcomes in orthodontic patients," *Journal of oral biology and craniofacial research*, vol. 11, no. 1, pp. 26–32, 2021.
- [25] H. M. Abozaid, and L. A. Amer, "Longitudinal Evaluation of Oral Health Among Orthodontic Patients Prior Treatment, During Treatment and Post-Treatment," *Al-Azhar Assiut Dental Journal*, vol. 4, no. 2, pp. 167-178, 2021.
- [26] M. Migliorati, L. Isaia, A. Cassaro, A. Rivetti, F. Silvestrini-Biavati, L. Gastaldo,... and Silvestrini-Biavati, "Efficacy of professional hygiene and prophylaxis on preventing plaque increase in orthodontic patients with multibracket appliances: a systematic review," *European journal of orthodontics*, vol. 37, no. 3, pp. 297-307, 2015.
- [27] N. C. Sharma, D. M. Lyle, J. G. Qaqish, J. Galustians and R Schuller, "Effect of a dental water jet with orthodontic tip on plaque and bleeding in adolescent patients with fixed orthodontic appliances," *American Journal of Orthodontics and Dentofacial Orthopedics*, vol. 133, no. 4, pp. 565-571, 2008.
- [28] S. R. Hussein and B. A. Hassan, "Assessment of Gingival Health Status among Patients with Fixed Orthodontic Appliance," *Polytechnic Journal*, vol. 11, no.1, pp. 38-41, 2021.
- [29] M. Eppright, B. Shroff, A. M. Best, E. Barcoma and S. J. Lindauer, "Influence of active reminders on oral hygiene compliance in orthodontic patients," *The Angle Orthodontist*, vol. 84, no. 2, pp. 208-213, 2014.