



## The Influence of Fixed Orthodontic Appliances on Periodontal Health Status

Omar Husham Ali <sup>(1)</sup>

(1) Department of periodontology, College of Dentistry, University of Baghdad, Iraq.

### Article Info:

#### -Article History:

-Received: 14/10/2019

-Accepted: 18/12/2019

-Available Online:

\*/12/2019

### Keywords:

### Corresponding Author:

Name: Omar Husham Ali

E-mail:

Tel:

Affiliation:

Dental teaching hospital

### Abstract

The orthodontic appliance may interfere with the removal of plaque, and interfere with the gingival health. Inflammation of the gingiva may start in patients wearing orthodontic appliance who do not maintain proper oral hygiene. As the parts of the orthodontic appliance associated with food deposits and bacterial accumulation. This plaque accumulation around the orthodontic appliance may lead to periodontal tissue inflammation and caries in teeth. The aim of this study was to determine the effect of fixed orthodontic appliance on the health of periodontium. The indices like plaque scale (PLS) gingival scale (GS), bleeding scale (BS).

### Introduction:

Periodontal disease (periodontitis) is an inflammatory disease that cause destruction in the supporting tissues of the teeth and is caused either by group or specific bacteria found within the dental plaque. The development of periodontal disease is affected by many different factors and their interferences <sup>(1)</sup>. The main factor in the starting, continuity and recurrence of gingival disease is a plaque <sup>(2)</sup>, which is aggregated on orthodontic appliances when the maintaining good oral hygiene is not obtained, which leads to periodontal tissues destruction <sup>(3)</sup>, such a side effect showing as periodontal deterioration caused by orthodontic appliance when the

appliance regarding as retentive factor for microbial dental plaque. The sites of plaque aggregation interfere with oral hygiene procedures and thus leading to the development of white spot lesions, caries, and inflammation of the periodontium <sup>(4,5)</sup>. The primary stage of tooth caries clinically appears as a chalky white patch on the enamel and under the microscope appears as an area of demineralization, with up to about 30% the mineral lost but having an apparently intact surface layer, this can be happened when the carbohydrate in the diet is taken up by the bacteria that found on the surface of the tooth which undergo metabolism, producing acid which hits the surface of enamel and eliminate the

calcium and phosphate mineral of which represent the main composition of enamel<sup>(6)</sup>. Malocclusion can be defined as an anomaly of the teeth or abnormal relationship of the dental arches beyond the natural range of what is accepted. There is an association of malocclusion with increased in the aggregation of dental plaque due to the difficulty of following proper techniques of brushing the teeth<sup>(3)</sup>. When a fixed orthodontic appliance is strapped up for the correction of the anomalies in dental arch, and enhance esthetic of teeth, which becomes increasingly the most common cause that makes patients undergoing orthodontic treatment. The effects of orthodontic treatment on the aesthetic are often readily appears; while the effect of the orthodontic treatment might have the invisible part of the microorganisms in the oral cavity.<sup>(7,8)</sup> The studies microbiologically revealed changes in the composition of supra and subgingival dental plaque flora significantly, so orthodontic treatment may influence the equilibrium of the oral microflora and increase the retention of microorganism<sup>(7)</sup>. The treatment with fixed orthodontic appliances initiates the growth of different types of microorganisms present in the plaque where some periodontopathogenic bacterial strains are prevalent such as *Porphyromonas gingivalis*, *Prevotella intermedia*, *Bacteroides forsythus*, *Fusobacterium nucleatum*, and *Treponema denticola*, the most reported to occur<sup>(9-11)</sup>. Most patients develop generalized gingivitis even if they are following proper techniques for tooth brushing. The probing depth increased during orthodontic treatment could also be due to over growth of the gingival tissue after the placement of orthodontic deartments. Phenomena such as inflammation, bleeding and enlargement of the gingiva and increased the pocket depth of the gingiva are observed<sup>(12)</sup>. There are Four possible reasons which may cause the impairment of periodontal health with orthodontic treatment<sup>(13,14)</sup>.

- 1- Orthodontic bands cause mechanical irritation to the gingival tissue.

- 2- The cement material used to retain the band which cause chemical irritation of the gingival tissue.
- 3- Increasing the risk of food retention and hence posterior gingival and periodontal excitation may occur.
- 4- Patient may tend to take care in the cleaning their anterior teeth more effectively than posterior teeth ,so increased formation of plaque.

So success in orthodontic treatment results depend on maintaining the oral hygiene, so maintaining the periodontal tissue<sup>(15)</sup>.

#### **Aims of the study:**

This study aims to: Evaluate the periodontal health in patients during treatment with fixed orthodontic appliance.

#### **Material and method**

This study made at the University of Baghdad, College of Dentistry. 110 patients, 58 males and 52 females with age range of 25-35 years were participated in this study. The subjects were divided into two groups: Group 1 (control group which composed from 55 patients without orthodontic treatment), Group 2 (which composed from 55 patients treated with fixed orthodontic appliance). The periodontal health status assessment clinically was performed through the period extending from Nov, 2018 – Feb, 2019, using plaque scale (PS)<sup>(16)</sup>, gingival scale (GS)<sup>(17)</sup>, bleeding scale (BS)<sup>(18)</sup>. After consents forms have been signed by all subjects confirm their agreement to collaborate in the study. A self-reported questionnaire was taken include: Name, age, full medical history, dental history, if patient wearing fixed orthodontic appliance or not, time of wearing the appliance, the periodontal parameters plaque scale (PS), gingival scale (GS), bleeding scale (BS).

The inclusion criteria:

- 1- Healthy patients without any systemic disease
- 2- Adult patients with the age range 25-35 years.

While the exclusion criteria:

- 1- Pregnant and menopause women
- 2- Smokers
- 3- Patient with systemic disease

## Results

The descriptive and statistical analysis showed that the mean and standard deviation for PS and GS for group I ( $0.57 \pm 0.57$ ), ( $1.02 \pm 0.07$ ) respectively while group II ( $1.03 \pm 0.34$ ), ( $1.09 \pm 0.22$ ) respectively. The mean and standard deviation for BS (zero%) and BS (One%) in group I ( $98.13 \pm 3.75$ ), ( $1.62 \pm 3.25$ ) respectively while for group II ( $86.14 \pm 9.80$ ), ( $13.96 \pm 9.45$ ) respectively. All the previous results appeared in Table (1). Inter group comparison for PS showed that there is high significance in plaque scale mean difference between the tested groups, the results appeared in Table (2) and Figure (1). Also in the intergroup comparison for GS showed high significance in gingival scale mean difference between the tested groups and the results appeared in Table (3) and Figure (2). The chi square for BOP in both group showed high significant difference in gingival index mean between the one and zero percentages in the two tested groups ( $P < 0.001$ ) and the Table (4) and figure 3 showed these results.

## Discussion

The results in this study showed higher inflammation in patient treated wearing fixed orthodontic appliance (group 2) in comparison to patients with healthy periodontium and not treated with fixed orthodontic appliance (group 1) and these results appeared in the higher mean values of dental plaque scale and gingival scale in the second group compared to first group. The increase in the plaque could be related to the complex components of the appliances like the bands, bonds and wires which make maintain a good oral hygiene

was difficult. The orthodontic departments may interfere with plaque removal, maintaining good oral hygiene and affect the health of the gingiva<sup>(19)</sup>. This difficulty in plaque control and the raise in the plaque score will lead to the development of gingivitis and it can become quite profound in 21 days<sup>(20)</sup>. This was appeared in the study by the raising in the gingival scale score and high percentage of bleeding sites in the subjects with fixed orthodontic appliances, these findings come in agreement with the result of Ristic et al<sup>(21)</sup> and Naranjo et al<sup>(19)</sup> who found that the fixed orthodontic appliances will influence the ecological environment by the accumulation of biofilm at the retentive sites. This may explain that patients treated with fixed orthodontic appliance have higher rate of plaque and gingival indices. However, control group showed significantly less plaque accumulation and gingivitis which confirm the easier brushing and better oral hygiene in the absence of orthodontic appliance. The increase in the scores of dental plaque in this study is in acceptance with other studies<sup>(12,15,22,23)</sup>. The patients wearing orthodontic appliance had a confront to the proper plaque removal from the oral cavity. In the first stages of plaque Gram-positive rods and cocci started the gingival surfaces and teeth then these dental bacteria are substituted by Gram-negative microorganisms, which may stimulate a gingival disease<sup>(23)</sup>. These microorganisms aggregate on the surface of tooth and they help to form the network for other colonization<sup>(24)</sup>.

## Conclusion

Patients who treated with fixed orthodontic appliance had generalized gingivitis even they were maintaining good oral hygiene. In general patients treated with fixed orthodontic appliance require special care measures to maintain good periodontal health.

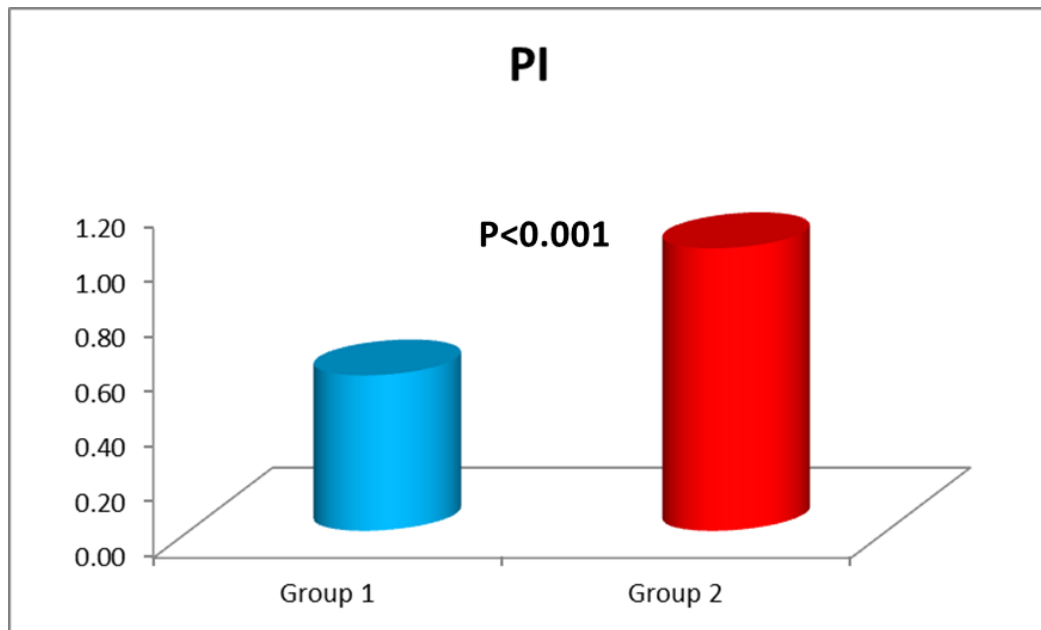


Fig.(1): Paired t- test compare Plaque Scale (PS) between THE FIRST GROUP (without orthodontic treatment) and THE SECOND GROUP (with orthodontic treatment)

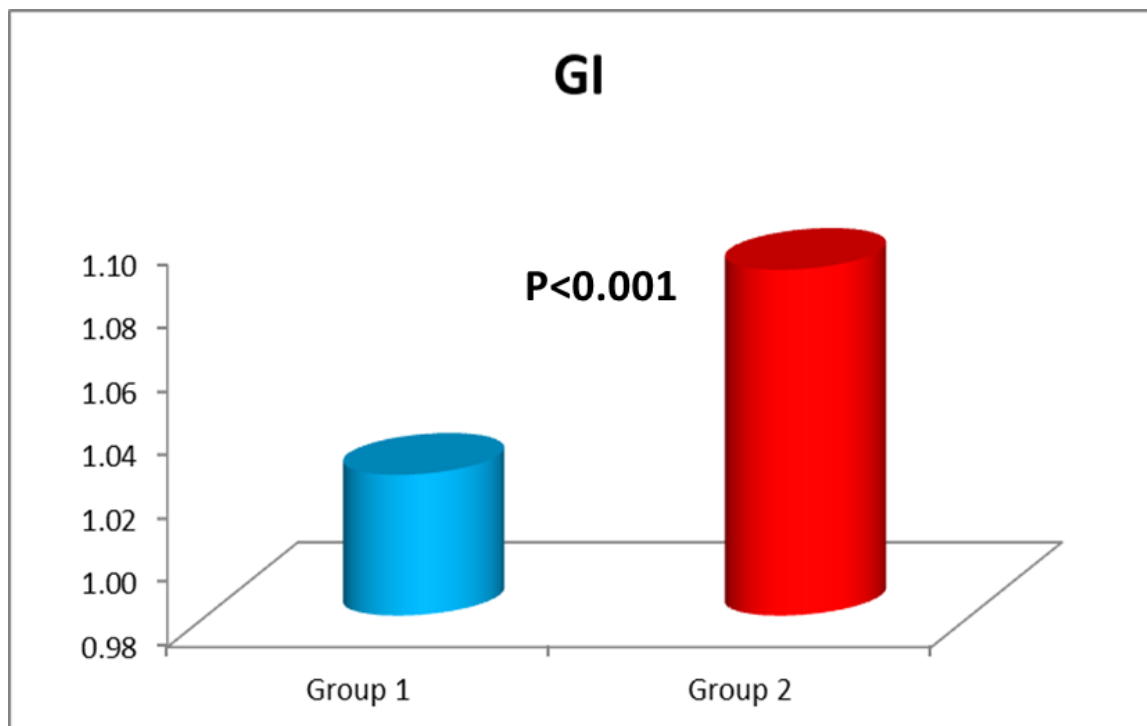


Fig.(2): Paired t- test compare Gingival Scale (GS) between THE FIRST GROUP (without orthodontic treatment) and THE SECOND GROUP (with orthodontic treatment)

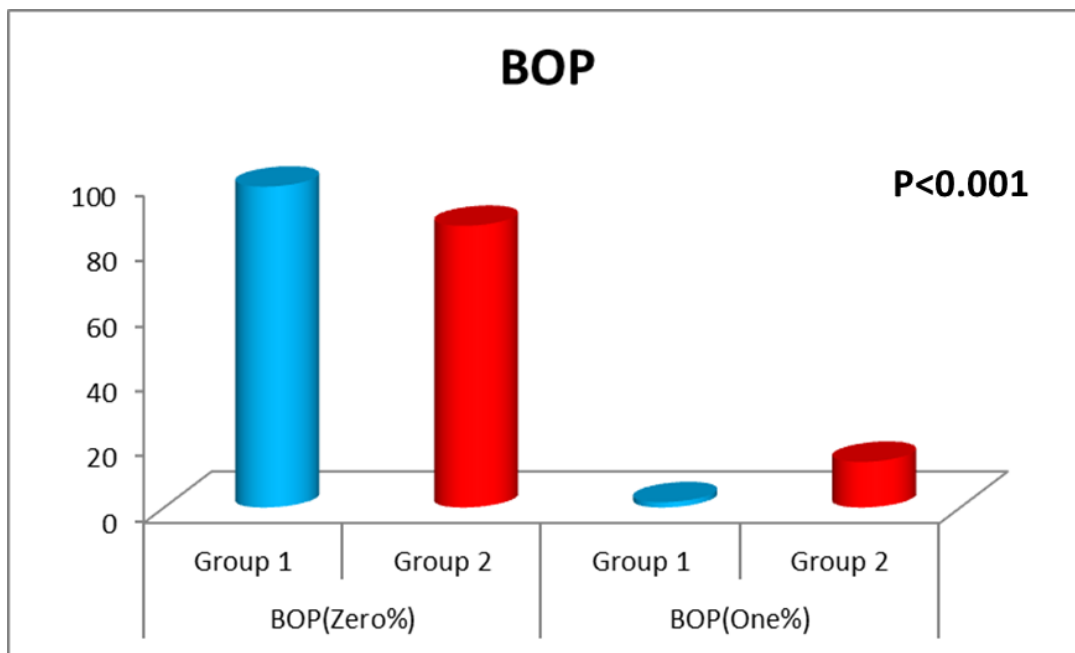


Fig.(3): Chi-square test compares Bleeding Scale (BS) between THE FIRST GROUP (without orthodontic treatment) and group 2THE SECOND GROUP (with orthodontic treatment)

Table (1):- Descriptive and statistical analysis of the demographic data

Statistics	PS		GS		BS (Zero %)		BS (One %)	
	First group	Secondary group	First group	Secondary group	First group	Secondary group	First group	Secondary group
Mean	0.57	1.03	1.02	1.09	98.13	86.14	1.62	13.96
SD	0.27	0.34	0.07	0.22	3.75	9.80	3.25	9.54

Table (2):- Descriptive and statistical analyses of the Plaque scale (PS) between THE FIRST GROUP (without orthodontic treatment) and THE SECOND GROUP (with orthodontic treatment).

PS	Mean	SD	t- test	P value	Sig
First group	0.57	0.27	3.03E-12	P<0.001	HS
Secondary group	1.03	0.34			

Table (3):- Descriptive and statistical analyses of the Plaque Scale (PS) between THE FIRST GROUP (without orthodontic treatment) and THE SECOND GROUP (with orthodontic treatment).

GS	Mean	SD	t- test	P value	Sig
First group	1.02	0.07	6.35E-05	P<0.001	HS
Secondary group	1.09	0.22			

Table (4):- Descriptive and statistical analyses of Bleeding Scale (BS) between THE FIRST GROUP (without orthodontic treatment) and THE SECOND GROUP (with orthodontic treatment).

BS	Groups	Mean	SD	Chi- square	P value	Sig
Zero%	First group	98.13	3.75	39.44	P<0.001	HS
	Secondary group	86.14	9.80			
One%	First group	1.62	3.25			
	Secondary group	13.96	9.54			

## References

- 1- Saini R. Ozone therapy in dentistry: A strategic review. *J Nat Sci Biol Med*; 2: 151–3, 2011.
2. Baka ZM, Basciftci FA, Arslan U. Effects of 2 bracket and ligation types on plaque retention: A quantitative microbiologic analysis with real-time polymerase chain reaction. *Am J Orthod Dentofacial Orthop*. 144 (2), 260- 267, 2013.
3. Sallum EJ, Nouer DF, Klein MI, Gonçalves RB, Machion L, Wilson Sallum A, et al. Clinical and microbiologic changes after removal of orthodontic appliances. *Am J Orthod Dentofacial Orthop*;126:3, 2004.
4. Bollen AM, Cunha-Cruz J, Bakko DW, Huang GJ, Hujoel PP. The effects of orthodontic therapy on periodontal health: A systematic review of controlled evidence. *J Am Dent Assoc*. 139 (4): 413-422, 2008.
5. Liu H, Sun J, Dong Y, Lu H, Zhou H, Hansen BF, et al. Periodontal health and relative quantity of subgingival *Porphyromonas gingivalis* during orthodontic treatment. *Angle Orthod*. 81 (4) : 609-615, 2011.
6. Levine R S .The aetiology of dental caries--an outline of current thought. *International Dental Journal* 27, 341-348(1977).
7. van Gastel J, Quirynen M, Teughels W, Coucke W, Carels C. Longitudinal changes in microbiology and clinical periodontal variables after placement of fixed orthodontic appliances. *Journal of periodontology*, 79(11): 2078-2086, 2008.
8. Gong Y, Lu J, Ding X. Clinical, microbiologic, and immunologic factors of orthodontic treatment-induced gingival enlargement. *American journal of orthodontics and dentofacial orthopedics: official publication of the American Association of Orthodontists, its constituent societies, and the American Board of Orthodontics* 140 (1): 58-64, 2011.
9. Zachrisson BU, Alnaes L. Periodontal condition in orthodontically treated and untreated individuals. II. Alveolar bone loss: Radiographic findings. *Angle Orthodontics*, 44(1): 48-55, 1974.
10. Gomes SC, Varela CC, da Veiga SL, Rösing CK, Oppermann RV. Periodontal conditions in subjects following orthodontic therapy. A preliminary study. *Eur J Orthod*. 29 (5): 477–481 2007.
11. Socransky SS, Haffajee AD. The bacterial etiology of destructive periodontal disease: Current concepts. *J Periodontology*: 63 (45): 322-331, 1992.
12. Kloehn JS, Pfeifer JS. The effect of orthodontic treatment on the periodontium. *Angle Orthod*; 44: 127–134, 1974.
13. Sukontapatipark W, el-Agroudi MA, Sellisetth NJ, Thunold K, Selvig KA. Bacterial colonization

associated with fixed orthodontic appliances. A scanning electron microscopy study. *European journal of orthodontics* 23(5) :475–484, 2001.

14. Demling A, Heuer W, Elter C, Heidenblut T, Bach FW, Schwestka-Polly R, et al. Analysis of supra- and subgingival long-term biofilm formation on orthodontic bands. *European journal of orthodontics*, 31(2):202–206, 2009.

15. Zachrisson S, Zachrisson BU. Gingival conditions associated with orthodontic treatment. *Angle Orthod*; 42:26-34, 1972.

16. Silness J, Loe H. Periodontal disease in pregnancy. II correlation between oral hygiene and periodontal condition. *Acat Odontol Scand* 1964; 22: 121-35.

17. Loe H, Silness: Periodontal disease in pregnancy. *Acta Odontol Scand*. 1963; 22: 533.

18. Newbrun E: Indices to measure gingival bleeding. *Journal of Periodontology* 1996; 67(6):555-561

19. Naranjo AA, Trivino ML, Jaramillo A, Betancourth M, Botero JE. Changes in the subgingival microbiota and periodontal parameters before and 3 months after bracket placement. *Am J Orthod Dentofacial Orthop* 130:275 e17-22, 2006.

20. Socransky SS, Haffajee AD, Cugini MA, Smith C, Kent RL. Microbial complexes in subgingival plaque. *J Clin Periodontology*, 1998.

21. Ristic M, Vlahovic Svabic M, Sasic M, Zelic O. Clinical and microbiological effect of fixed orthodontic appliances on periodontal tissues in adolescents. *Orthod Craniofac Res*; 10:187-95, 2007.

22. Zachrisson BU. Clinical implications of recent orthodontic/periodontic research findings. *Semin Orthod* 1996;2:4-12.

23. Huser MC, Baehni PC, Lang R. Effects of orthodontic bands on microbiologic and clinical parameters. *Am J Orthod Dentofacial Orthop* 1990;97:213-8.

24. Eckley B, Thomas J, Crout C, Ngan P. Periodontal and microbiological status of patients undergoing orthodontic therapy. *Hong Kong Dent J*. 9:11–20, 2012.