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A Comparative Study of Gingival Health of Orthodontic Patients with Bands and Buccal Tubes on First Molars

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ABSTRACT

Objectives: To calculate the gingival index of molars with bands before, and at a duration of 3 and 6 months of orthodontic treatment and to compare the scores with the other group which has buccal tubes on the molars.

Materials and Methods: 30 patients each in two groups (A and B) by using the random sampling technique. Group A had bands cemented on the first molars while Group B had buccal tubes. The variable of gingival Index was then quantified and noted for comparison and analysis.

Results: In the banded group when the gingival index was recorded before the start of the orthodontic treatment (T0), the values were low as compared to the index at 3 and 6 months (designated as T1 and T2, respectively). The recorded variable however, gave a decreased value in the bonded group. Banded teeth provided a greater surface for bacterial and foreign body accumulation and lesser surface for maintenance of oral hygiene thus resulting in inflammation around the tooth.

Conclusion: When a good oral hygiene is maintained by the patient throughout the fixed orthodontic treatment a better Gingival index with time is seen when buccal tubes are used rather than bands.

Keywords: Gingival Health, Oral Hygiene, Orthodontic Bands, Orthodontic Buccal Tubes

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INTRODUCTION

With the awareness of esthetic concerns more adults are now opting to get fixed orthodontic treatment. This increases the apprehension for periodontal health particularly in those patients who have a deprived oral hygiene. The tooth supporting structures consist of cementum, alveolar bone, periodontal ligaments and gingiva. When orthodontic appliances are inserted in the mouth, they become retentive areas for plaque accumulation. This leads to multiplication of bacterial colonies, and inflammation results affecting the periodontium. It becomes necessary to give appropriate oral hygiene directives to the patients and then stress upon them throughout the treatment or else a deterioration of the periodontal health is seen.

Inflammation of the gingiva is termed as gingivitis. After plaque accumulation it takes about 4 to 7 days for gingivitis to occur with poor oral hygiene.[1] However gingivitis is a reversible process but when converted to periodontitis, the renewal of the attachment unit is not predictable. The periodontium loses its attachment and thus results in the destruction of the ligament fibers of periodontium.

Gingivitis is more common in children and it has been defined as a lesion confined to the marginal gingiva. After two to three weeks of development of gingivitis an increase of plasma cells occurs within the lesion. This lesion becomes established depending on dietary factor and whether oral hygiene measures are taken or not, before becoming aggressive and then advancing to advanced lesions.[2,3,4] Thus the differentiating point between gingivitis and periodontitis is that plaque induced gingivitis is the inflammation of the tissues without any attachment loss[1,5] whereas periodontitis is the occurrence of gingival attachment at positions where there has been a previous pathological separation of the collagen fibers from the cementum and there is apical migration of the junctional epithelium.[1]

There is a close relationship between orthodontics and periodontal tissues since the process involves implication of direct or indirect forces on the teeth and if the oral hygiene practices are not properly adapted by the patients during the progression of the treatment, worsening in the periodontal wellbeing will be obvious in the first few months. Since the treatment of straightening the teeth requires attachments, wires, bands and brackets, these can act as sites for plaque retention and can make cleaning of the teeth more difficult.[1-6,7] This would eventually result in inflammation of the tissues surrounding the teeth. Due to esthetic concerns and awareness more adult patients are undergoing orthodontic treatment hence more stress should be implied on the cleaning measures in these patients.[8,9]

Efficient tooth movement requires the placement of properly controlled forces which would bring about the tooth movement without causing any harm to the supporting structures of the tooth. The pressure tension theory is widely accepted in this regard. When pressure is applied on a tooth there is compression of the periodontal ligament and changes in the local blood flow levels occur[1,8,10] and ultimately pressure and tension sides are formed. Resorption of bone occurs on the compression side and consequently the strain side is seen with deposition of the bone until the normal biological width of the PDL is regained.[8,11,12]

Under normal conditions of chewing and phonetics the tooth is in a neutral zone of equilibrium and no movement results. A minimum force of 5 to 10 g/cm2 is required to bring tooth movement and to move the tooth out of equilibrium.[9,13] Excessive forces produce compression of the blood vessels resulting in hypoxia and release of prostaglandins and cytokines. These mediators result in the osteoblast-osteoclast activation, with excessive forces resulting in the hyalinization as a result of necrotic tissue. There will be only small amounts of bone apposition and this will result in slow tooth movement.[8,14] As soon as the molar band is cemented to the first molars there is an alteration in the oral environment of the tooth. Being in close contact to the gingiva, an orthodontic band discloses more external area for the accrual of fragments and plaque, and thus in order to preserve the cleanliness around a banded tooth vigorous cleaning measures are required throughout the stretch of treatment.[11,15] On the other hand bonding of buccal tubes show better results in terms of preservation of the periodontal standing. Despite being a not as much of a common practice the bonding of teeth with buccal tubes exposes decreased number of retentive sites for plaque accumulation resulting in lesser or no inflammation around the tooth. The purpose of this study was comparability of bands to bonded add-ons on first molars in relationship to inflammation around the concerned tooth that would unswervingly

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disturb the periodontal standing of the teeth involved.

MATERIALS AND METHODS

This comparative analytical study was carried out for a period of 2 years. The Institutional Review Board of Islamabad Dental Hospital gave the ethical approval (Ref.No.F.2/11/ AS&RB-57/2019) for this study. The WHO sample size calculator was used to calculate the sample size of sixty patients for this study. Thirty patients each were randomly placed in the two groups A and B by using the Computerized Lottery Method. Inclusion criteria for this study was good oral cleanliness, having completely erupted upper and lower first and second molars. Exclusion criteria included patients with a past orthodontic treatment, occurrence of long-lasting medical ailment or an infection that could affect their periodontium. Patients with Class II and V fillings or fixed prosthetic device on the posterior teeth, patients having a traumatic bite and bruxism and those whose orthodontic treatment plan included orthodontic appliances were as well omitted from this study.

Patients in Group A had cementation of orthodontic bands on their first four molars with glass ionomer cement. Patients in Group B had buccal tubes etched using 37% phosphoric acid and cured on the four first molars. Ora hygiene instructions were given to patients in both groups at the start of the study and also at every follow up.

The gingival index was assessed for each tooth on the basis of Löe and Silness Scale according to the following classification:

0= absence of inflammation

1= mild inflammation with slight change in color and texture

2= moderate inflammation with reddish appearance, mild edema and hypertrophy and bleeding on probing

3= severe inflammation, with marked reddish appearance and hypertrophy, ulceration and tendency to spontaneous bleeding

The gingival index was measured at three points in time for every patient. Every first molar under study in the two groups was examined and the gingival index measured before the start of treatment (T0), after 3 months (T1) and 6 months (T2) to be recorded in a proforma. All the four surfaces (mesial, distal, buccal and lingual) were examined and a score of 0-3 was given to the gingival tissue of each side, giving the GI for that particular area. The scores from these 4 portions of the tooth were added and divided by four to give the GI for the tooth. For entering the reading, the highest value was taken for the GI of the patient at that period of time. All measurements recorded by the same researcher were rounded off to the nearest millimeter. For statistical comparison Mann Whitney U test was applied for comparability of gingival index in both groups at T0, T1 and T2. Paired sample- t test was used for the pre- and post-comparison within one group.

RESULTS

Sixty patients were selected as the sample size for this study with random distribution of 30 patients each in both groups. Figure 1 shows the age wise distribution of the sample, giving the average age of 18 years with maximum and minimum ages of 27 and 12 years respectively.

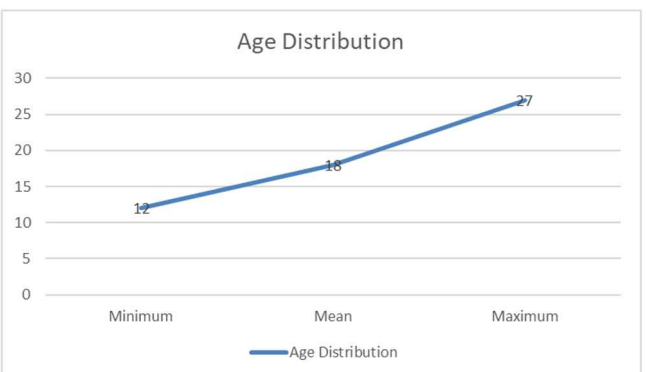

Figure 1: Age wise distribution in both groups

Gender wise distribution of patients in Group A with bands gave percentages of 67% and 33% for females and males respectively. While in group B with buccal tubes 60% females and 40% males were randomly distributed as shown in Figure 2.

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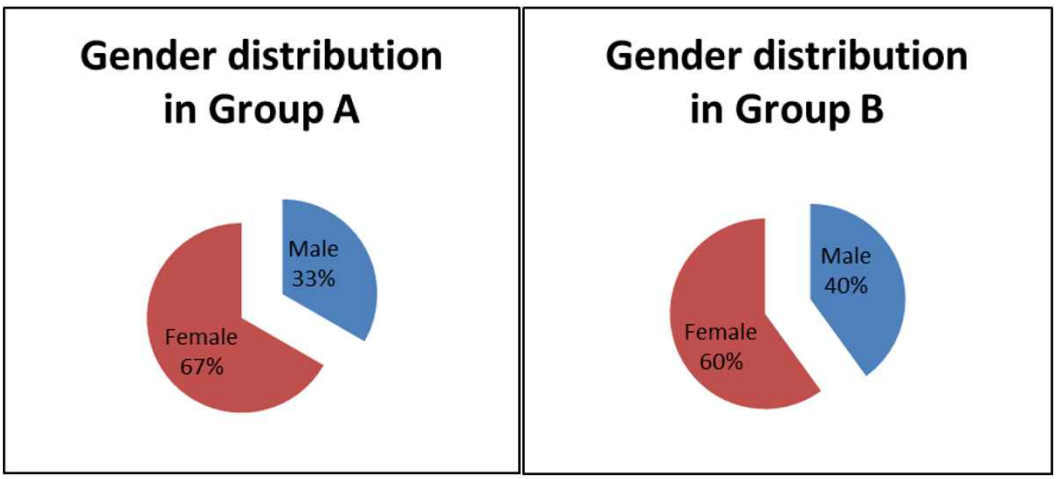

Figure 2: Gender wise distribution of both groups

Table I demonstrates the comparison of group A at three periods of time when the periodontal status was assessed with regard to the Gingival Index by means of the Paired-sample T test.

Table I: Gingival Index at T0, T1 and T2 of Group A (Bands) and Group B (Buccal tubes)

		Gingival Index (Bands)		Gingival Index (Buccal Tubes)	
N=30		Mean ±Std. Deviation	*p*-value	Mean ±Std. Deviation	*p*-value
Pair 1	**T0**	0.97±.556		0.97±0.669	0.403
	T1	1.17±.379	0.110	0.83±0.592	
Pair 2	**T1**	1.17±.379	0.001	0.83±0.592	0.255
	T2	1.53±.681		0.70±0.702	
Pair 3	**T0**	0.97±.556	0.000	0.97±0.669	0.147
	T2	1.53± .681		0.70±0.702	

In this group first molars had bands cemented on them. When the GI scores before treatment was compared with the GI scores at 3 months after treatment the results were insignificant. Comparison of the GI scores at T1 and T0 gave significant results with a mean value and standard of deviation of 1.1.7±379 and 1.53±681 respectively, thus showing an increase in the GI scores as the treatment proceeds in patients having molar bands. The results of Table 1 gave insignificant values when the other group with buccal tubes was compared at different times using the paired-sample T test. GI scores before treatment compared to GI scores at T1 did not give a significant change. Same results appeared when the GI scores at T1 were compared with the scores at T2. These results showed that GI scores decreased with time as seen from the mean values in the table above but this change is insignificant during the first 6 months of treatment.

Comparing both groups amongst themselves significant change was seen after applying Mann- Whitney U test, from T0 to T2 as shown in Table 2. GI scores in the banded group changed from the start of the treatment to T1 and a further increase was seen when the GI was recorded at T2 in this group. When the banded group was compared to the buccal tubes a significant difference was seen at T2 (*p*-value 0.000).

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Table 2: Comparison of GI before, at T0, T1 and T2 between Group A and B

Gingival Index – prior treatment			
Groups	**Mean ± SD**	**Mann-Whitney U**	***p*-value**
Band	0.97 ± 0.610	449.000	0.986
Buccal Tube	1.50 ± 0.504		
Gingival Index - 3 months later			
Groups	**Mean ± SD**	**Mann-Whitney U**	***p*-value**
Band	1.00 ± 0.521	320.000	0.013
Buccal Tu be	1.50 ± 0.504		
Gingival Index - 6 months later			
Groups	**Mean ± SD**	**Mann-Whitney U**	***p*-value**
Band	1.12 ± 0.804	186.500	0.000
Buccal Tube	1.50 ± 0.504		

DISCUSSION

Inflammation of the gingiva is termed as gingivitis. After plaque accumulation it takes about 4 to 7 days for gingivitis to occur with poor oral hygiene.[1] However gingivitis is a reversible process but when converted to periodontitis, the rejuvenation of the attachment tissue is not predictable. The periodontium loses its attachment and obliteration of the periodontal tissues result. Gingivitis becomes established depending on dietary factor and whether oral hygiene measures are taken or not, before becoming destructive.[2-4] There is no attachment loss with plaque induced gingivitis but the inflammation is there.[1,5] Periodontitis however results in destruction of the collagen fibers from the cementum and the junctional epithelium has migrated apically.[1]

An increase in perio-pathogenic bacteria is seen after start of the orthodontic treatment and there is a shift of aerobic to anerobic bacteria. These changes in the composition of bacteria are found within 12 days of treatment where by larger quantity of motile rods and cocci are seen. There is an increase seen in the motile spirochetes and rods within 6 weeks and a subsequent decrease in the cocci. Red and orange complexes of bacteria are established by 3 months. The placement of orthodontic bands sub gingivally itself induces gingivitis, altering the surrounding oral environment and development of red complexes of bacteria takes place.[1,6,9,10]

The significant risk factors for raised gingival index are plaque, subgingival cervical margins of the bands, increased probing penetration, and extent of fixed orthodontic treatment.[18] Taking the first risk factors into account, an inequity between the plaque elements and the defense mechanism of the host would result in periodontal breakdown.[13-15] Placing bands that impinge into the sulcus i.e. sub-gingivally augment the likelihood for developing inflammation. If the cervical margins of the bands are prevented from invading the subgingival areas of the molars it would be more advantageous.[12,14,15,17,18]

The change of gingiva from the normal stippled appearance into an inflamed tissue with bleeding and swelling involves many variables of periodontal health to change from their normal. Thus, more studies are required to record and analyze the periodontal variables in detail and to compare them at different time periods during the treatment so that the use of bonded attachments on molars can be more strongly promoted for long term benefits to the periodontal health. The responsibility of an orthodontist increases to two-folds as soon as the treatment is started. Complete oral hygiene upkeep proprieties for home must be ensured and also scrutinizing on every visit if the directions given are being acted upon or not.[7,19]

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The fact that patients in our surroundings are very careless towards their oral health. Flossing of teeth aside, patients do not even brush their teeth properly and regularly resulting in plaque accumulation around the teeth especially in the interproximal areas. Since cementation of a bands results in covering of all the surfaces of the tooth, the margins of the band and the wire slots and hooks provide additional retentive positions for plaque. This results in increased probabilities for the bacteria to stick to and colonize at the proximal sites as depicted in our study. After some time if the plaque is not removed from around the tooth especially from the interdental areas, there is inflammation of the gingiva, as revealed by the increased gingival index in this study. This detail was also perceived in other studies.[7,19] When patients have fixed appliances in their oral cavity after any restorative or esthetic procedure there are more chances of interdental areas being affected since cleanliness becomes more difficult in these areas, as suggested by Feu D in their study.[20] Singla et al. in their research stated the fact that inflammation of the gingiva is initiated by improper location of the band.[21] Other studies have also stated the similar factor that impingement of cervical circumference of the band into the gingival sulcus will definitely increase the occurrence of inflammation i.e. gingivitis.[1,12,16] An additional imperative fact is that a loose band during the progression of the treatment creates an addition site for plaque by providing space for bacterial and debris accumulation.

When group A was compared with group B, the GI was seen to decrease a little as an improved compliance to oral hygiene procedures were observed in patients with buccal tubes, since a larger surface of the tooth was available for them to clean. As a result of greater salivary flow around the tubes and more area available for cleaning the amount of plaque accumulated around the first molars of group B was less (Table I and II). This resulted in lower values of the gingival index and a declining pattern of index change was observed. This fact is reinforced by the research done by Amir et al.[22] On the other hand, the band covers the tooth surfaces from every side, increasing the retentive locations for plaque. Also, after cementation of the bands if the dentist is careless in removing the excess cement from around the band circumference, tubes and hook, and from the tooth surface, additional plaque retentive sites will be formed making it extra tough for the patients to clean. Cleaning becomes easier when buccal tubes are bonded on the tooth as retentive sites are eliminated or reduced. These results of the present study have also been supported by Amir et al. and Sharab et al., who stated that more plaque retention and eventually greater values of GI were found on banded teeth.[22,23] Mandibular molars with bonded tubes gave an increased GI when compared to the maxillary molars.[23] Tonetti 8 in his study on one or two variables of periodontal status, stated the fact that gingival index calculated in a patients teeth gave statistically significant results for bands and statistically insignificant results for bonds evaluated at different times during the orthodontic treatment. Same results have been reported by the present study in which all the variables important for evaluating the periodontal status have been studied together in the population of the area representing patients with a moderate sense of oral hygiene maintenance.

CONCLUSION

It was concluded that Gingival Index (GI) scores increased for both the banded and bonded groups. Also, as the treatment progressed, an increase in the accumulation of plaque was seen with bands especially after 6 months of treatment. More longitudinal studies are required to evaluate the periodontal health in patients undergoing fixed orthodontic treatment. There is a need for histological studies to disclose exact tissue alterations at different time zones during treatment with respect to periodontal wellbeing.

Variable of age and gender can be a factor of bias in this study. There was no equal distribution of all age groups and gender as randomization was done. Further evaluation is required to study the effects of age and gender on periodontal health.

DISCLAIMER

None.

CONFLICT OF INTEREST

None to declare.

ETHICAL STATEMENT

The Institutional Review Board of Islamabad Dental Hospital gave the ethical approval (Ref.No.F.2/11/AS&RB-57/2019) for this study.

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AUTHORS CONTRIBUTION

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Analysis and interpretation of data: N.B. Khan, S. Saqib, S.H. Qazi, K. Nawadat

Drafting of the manuscript: N.B. Khan, S.Saqib, S. H. Qazi, K. Nawadat

Critical review of the manuscript: H.S. Qazi, N.B. Khan

Approval of the final version of the manuscript to be published: M. Niazi, S. Saqib, K. Nawadat, S. H. Qazi, N.B. Khan, H.S. Qazi

REFERENCES

1. Priyadarsi U, Alam M, Hussain A, Azam F, Lal H, Parveen G. Awareness about periodontal health among patients with fixed orthodontic appliance. Int J Oral Care Res. 2020;8(2):20-22. DOI: 10.4103/INJO.INJO.
2. Partouche AJD, Castro F, Baptista AS, Costa LG, Fernandes JCH, Fernandes GVdO. Effects of Multibracket Orthodontic Treatment versus Clear Aligners on Periodontal Health: An Integrative Review. Dent J. 2022;10(10):177. https://doi.org/10.3390/dj10100177
3. Gehlot M, Sharma R, Tewari S, Kumar D, Gupta A. Effect of orthodontic treatment on periodontal health of periodontally compromised patients. Angle Orthod. 2022;92(3):324-32. doi: 10.2319/022521-156.1.
4. Zasčiurinskienė E, Lund H, Lindsten R, Jansson H, Bjerklin K. Outcome of periodontal-orthodontic treatment in subjects with periodontal disease. Part II: a CBCT study of alveolar bone level changes. Eur J Orthod. 2019;41(6):565–74.
5. Issa FHKM, Issa ZHKM, Rabah AF, Hu L. Periodontal parameters in adult patients with clear aligners orthodontics treatment versus three other types of brackets: A cross-sectional study. J Orthod Sci. 2020;9(2):4-9.
6. Zasčiurinskienė E, Lund H, Lindsten R, Jansson H, Bjerklin K. Outcome of periodontal-orthodontic treatment in subjects with periodontal disease. Part II: a CBCT study of alveolar bone level changes. Eur J Orthod. 2019;41(6):565–574.
7. Madariaga A.C.P, Bucci R, Rongo R, Simeon V, D'Antò V, Valletta R. Impact of fixed orthodontic appliance and clear aligners on the periodontal health: A prospective clinical study. Dent J. 2020;8(1):4-7.
8. Tonetti MS, Greenwell H, Kornman KS. Staging and grading of periodontitis: framework and proposal of a new classification and case definition. J Periodontol. 2018;89(S1):159-72.
9. Mousa MR, Hajeer MY, Burhan AS, Heshmeh O. The Effectiveness of Conventional and Accelerated Methods of Orthodontic Traction and Alignment of Palatally Impacted Canines in Terms of Treatment Time, Velocity of Tooth Movement, Periodontal, and Patient-Reported Outcomes: A Systematic Review. Cureus. 2022;10;14(5):24888. doi: 10.7759/cureus.24888.
10. Kumar S, Hassan N, Anjan R, Shaikh S, Bhowmick D. A Comparative Assessment of the Effect of Professional Oral Hygiene Measures on the Periodontal Health of Patients Undergoing Fixed Orthodontic Appliance Therapy. J Pharm Bioallied Sci. 2021; 13:1324–26.
11. Zaidi N, Moosa Y, Omer SA, Mazhar S, Rizvi KF, Shaikh AA. Comparison Of Periodontal Health of Orthodontic and Non-Orthodontic Patients. J Bahria Univ Med Dent Coll. 2020;10(2):102-105. DOI: https:// doi.org/10.51985/JBUMDC2019075.
12. Almansob Y.A, Alhammadi M.S, Luo X.J, Alhajj M.N, Zhou L, Almansoub H.A, Mao J. Comprehensive evaluation of factors that induce gingival enlargement during orthodontic treatment: A cross-sectional comparative study. Niger J Clin Pract. 2021; 24(2):1649–55.
13. Hamid F, Bangash A. A, Khan M, Tariq S, Saeed M. Difference in microflora between banded and bonded orthodontic attachment. Pak Armed Forces Med J. 2020;70(5):1434–8.
14. Theodoro L.H, Marcantonio R.A.C, Wainwright M, Garcia V.G. Laser in periodontal treatment: Is it an effective treatment or science fiction? Braz Oral Res. 2021;35(2):1-18. doi: 10.1590/1807-3107bor-2021.vol35.0099.

DOI:10.33897/fujd.v4i2.409

15. Salvi G.E, Stähli A, Schmidt J.C, Ramseier C A, Sculean A, Walter C. Adjunctive laser or antimicrobial photodynamic therapy to non-surgical mechanical instrumentation in patients with untreated periodontitis: A systematic review and meta-analysis. J Clin Periodontol. 2020; 47:176–98. doi: 10.1111/jcpe.13236.

16. Singla S, Kamboj M, Gupta P, Lehl G, Talwar M. Clinical evaluation of periodontal status in subjects with multibracket appliances and the role of age and gender during initial months of fixed orthodontic treatment. J Indian Soc Periodontol. 2022 ;26(4):353-358. doi: 10.4103/jisp.jisp_734_20. Epub 2022 Jul 2. PMID: 35959309; PMCID: PMC9362814.

17. Guo R, Zheng Y, Zhang L, Shi J, Li W. Salivary microbiome and periodontal status of patients with periodontitis during the initial stage of orthodontic treatment. Am J Orthod Dentofacial Orthop. 2021;159(5):644-652. doi: 10.1016/j.ajodo. 2019.11.026.

18. Hadzic S, Gojkov-Vukelic M, Pasic E, Jahic IM, Muharemovic A, Redzepagic-Vrazalica L, et al. Evaluation of periodontal changes in patients before, during, and after a fixed Orthodontic therapy. Mater Sociomed. 2022;34(2):121-25. doi: 10.5455/msm.2022.34.121-125.

19. Rahman MA, Rahman MM, Paul KC, Haque IE. Comparative Study of Orthodontic Molar Bands and Buccal Tubes in regards of Periodontal Status. J Oral Health. 2020;25(2):1-5.

20. Feu D. Orthodontic treatment of periodontal patients: challenges and solutions, from planning to retention. Dental Press J Orthod. 2021; 25:79-116.

21. Singla S, Kamboj M, Gupta P, Lehl G, Talwar M. Clinical evaluation of periodontal status in subjects with multibracket appliances and the role of age and gender during initial months of fixed orthodontic treatment. J Indian Soc Periodontol. 2022;26 (4):353-8.

22. Amir M, Iqbal A, Maqsood F, Saif U, Parvez M, Khan TA. The effect of orthodontic banding on gingival health of first permanent molars. Professional Med J. 2023;30(4):546-50.

23. Sharab L, Loss C, Jensen D, Kluemper GT, Alotaibi M, Nagaoka H. Prevalence of white spot lesions and gingival index during orthodontic treatment in an academic setting. Am J Orthod Dentofacial Orthop. 2023;163(6):835-42.