https://doi.org/10.37723/jumdc.v15i3.867

J. Univ. Med. Dent. Coll.2024;Vol.15(3): 890-895
ISSN (Print) 2221-7827, ISSN (Online) 2310-5542
https://www.jumdc.com

Original Article

Open Access

Evaluation of correlation between compliance of a patient towards orthodontic treatment and plaque accumulation in the lower anterior region with fixed orthodontic appliances. A cross-sectional study

Hafsa Riaz [a] , Maria Tanveer [a]

[a]Demonstrator, Department of Orthodontics, PMC Dental Institute, Faisalabad Medical University, Faisalabad.
Correspondence: drhafsariaz@gmail.com*

ABSTRACT

BACKGROUND & OBJECTIVE: Using orthodontic appliances can offer new spots for the oral microbiota and dental plaque to attach. Poor oral hygiene can lead to gingivitis and tooth decay resulting in the removal of braces to repair damage and delay treatment. Orthodontic patients who are mindful of their oral health often show greater compliance with their treatment. They tend to miss fewer appointments and avoid losing brackets, demonstrating a strong commitment to their orthodontic care. This study aims to find a correlation between plaque accumulation and patients' compliance with their orthodontic treatment.

METHODOLOGY: 50 orthodontic patients (20 males and 30 females, aged 11 to 25 years) were assessed at their 3rd, 4th, or 5th appointments. The plaque index for each patient was calculated on these appointments. Patient compliance like appointment follow-ups and bracket failures was recorded. A correlation was found between the plaque index and compliance of the patient.

RESULTS: A statistical analysis revealed a significant, strong negative correlation between the rate of following appointment follow-ups and the plaque scoring index ($r = -0.832$, P value < 0.001), and a significant, strongly positive correlation between bracket failure rate and plaque scoring index ($r = 0.795$, $P < 0.001$). Patients who had good attendance at follow-up appointments and low bracket failure had lower mean plaque score indices.

CONCLUSION: Patients with good compliance in terms of low bracket failure rate and attending follow-up appointments regularly tend to have lower plaque scores.

KEYWORDS: Plaque index, Bracket failure, Gingivitis, Patient compliance.

INTRODUCTION

Dental plaque is a complex biofilm structure that has been identified as the primary culprit in causing dental caries and periodontal disease. The use of orthodontic treatment involving fixed appliances can increase the risk of plaque buildup [1]. It is necessary to assess dental plaque to accurately evaluate the oral hygiene of individual patients using fixed appliances and to measure plaque in clinical studies [2]. Orthodontists can effectively address malocclusions with a range of removable, fixed, and functional appliances, leading to improved dentofacial aesthetics, functionality, and speech [3]. For fixed orthodontic treatment to be successful, the brackets must remain firmly attached to the teeth, allowing force to be applied.

One of the most typical issues faced by orthodontists is the breaking of brackets and patients not taking their appointments seriously, which can be frustrating during orthodontic treatment. Clinical evidence suggests that certain patients are more liable to bracket breakage than others. When brackets break, this increases the chair-side time and lengthens the treatment time as well as results. The success of orthodontic treatment relies significantly on the patient's understanding and adherence to oral hygiene instructions and appliance maintenance [4].

Numerous operator-related factors can contribute to bracket failure, such as the bonding technique, patient cooperation, compliance with dietary and oral hygiene instructions, the type of etchant or adhesive utilized, and the properties of the bracket itself. Decreased office activities, appointment cancellations, and patient hesitancy can directly affect the duration of orthodontic treatment[5-8]. Research demonstrated that motivation and cooperation by the patient during orthodontic treatment can have a considerable effect on the time required for treatment and the ultimate quality of the results [9-11]. In this study, we investigated the association between patient adherence to the doctor's instructions (i.e. oral hygiene), the success rate of their brackets, and their appointment attendance with the plaque scoring index.

How to cite this: *Riaz H ,Tanveer M .Evaluation of correlation between compliance of a patient towards orthodontic treatment and plaque accumulation in the lower anterior region with fixed orthodontic appliances. A cross-sectional study . Journal of University Medical & Dental College. 2024;15(3):890-895.*

Good oral hygiene paired with regularly scheduled orthodontist appointments are key to successful orthodontic treatment. Patient compliance plays an important part in treatment duration. The allure of a captivating smile serves as a primary motivation for individuals to pursue orthodontic treatment [12]. By following an orthodontist's recommendations, you can help ensure the quality of treatment. These recommendations include eating the right foods, maintaining good oral hygiene, wearing elastics, and attending scheduled appointments. Patients demonstrate greater adherence when they have the perception that their behaviors will lead to better treatment outcomes than when they think do not influence the results of the treatment.

This study aims to determine the relationship between patient compliance with orthodontic treatment demonstrated by regular attendance at appointments, consistent follow-ups, and avoiding bracket breakage and plaque accumulation in the lower anterior region. This study will help orthodontists in selecting a patient or emphasizing oral health maintenance instructions and tools to better support them.We hypothesize that there will be a negative correlation between plaque scoring and compliance of a patient.

METHODOLOGY

Individuals enrolled in the orthodontic department at Allied Hospital/Faisalabad Medical University were recruited for the study. The total duration of my study was 6 months (10-06-2023 to 10-12-2023) and it was conducted in the dental OPD of Allied Hospital Faisalabad. All participants and their guardians provided written consent and permission prior to being included in the research. The study was authorized by the Research Ethics Board at FMU vide letter No. F.48-ERC/FMU/2022-23/279 Dated 08-06-2023 and was carried out according to accepted ethical standards.

Recruitment of participants was based on the criteria of being healthy, requiring fixed orthodontic treatment, and displaying either good or fair oral hygiene as evidenced by the absence of inflamed gingiva at the time of recruitment. No individuals with a record of taking antibiotics within the past 6 months, a professional cleaning within the past 3 days (to allow the biofilm to be established and become mature), or cavities present in the lower front teeth were eligible for the study.

After the initial bonding appointment, each individual was given a package of oral hygiene items, including a toothbrush, floss, floss threaders, and a proxy brush. Subsequently, Participants were given step-by-step instructions on the proper use of the items and were then provided with the opportunity to practice. To observe the build-up of dental plaque, the HurriView Snap-n-Go swabs (Beutlich Pharmaceuticals LLC, Bunnell, Fla) were employed to reveal the surface of mandibular central and lateral incisors and canines as recommended by the manufacturer. The orthodontic plaque index proposed by Attin, Thon, Schlagenhauf, Werner, Wiegand, and Hannig [13] and implemented by Bock, Von Bremen, Kraft, and Ruf [14] was employed to calculate the plaque index (PI) of the patients at their third, fourth, or fifth appointment. The equation used to ascertain the PI was PI = (sum of plaque scores × 100)/ (number of teeth evaluated × 3).

The compliance of patients was evaluated by logging the number of missed appointments and bracket breakage. A previously crafted Performa was given to the patient's doctor, scoring plaque and providing information on the patient's adherence, such as rates of bracket failures and instructions for appointment follow-ups. This information was then recorded using Performa.

Plaque index scoring; adapted from Bock, Von Bremen [14] and originally introduced by Attin, Thon [13]

Score	Description
0	No visible plaque
1	Moderate accumulation on surfaces lateral to to the brackets
2	Moderate accumulation on surfaces lateral to the brackets and the cervical to the brackets (islands of plaque cervical brackets)
3	Moderate accumulation on surfaces lateral to the brackets and 1/3 of the surface gingival to the bracket covered with plaque

A patient with a plaque index score of 2

The data were input into Microsoft Excel, and a statistical analysis was carried out using SPSS version 24.0 (SPSS Inc., Chicago, IL, USA). Continuous variables were expressed as mean ± SD and categorical variables were shown as frequencies and percentages. Pearson point biserial correlation test was employed to assess correlations between bracket failure rates and patient compliance and following appointments and patient compliance. A p-value of 0.05 was considered as significant.

RESULTS

In the present study, a total of 50 patients with the age of 12 to 25 years with their fixed orthodontic treatment were studied. There were 30 (60%) males and 20 (40%) females. The total duration of the study was 3 months.The mean plaque scoring index was 67.5 ± 31.6 (range 5.6 – 100). All the patients with very high plaque scoring index also showed poor compliance towards orthodontic treatment. They had higher rates of frequent bracket failure and missing follow-

ups as shown by the higher mean PI in patients with frequent bracket failure (89.6 ± 8.12) and with missing follow-ups (88.8 ± 9.46) (Table -I).

From the total number of subjects, 28 (56%) individuals were observed to show poor compliance in terms of frequent bracket failure, whereas 22 (44 %) individuals were observed with rare bracket failure. Similarly, 30 (60%) individuals missed their follow-up appointments and hence showed poor compliance. Most of them were the individuals who were also observed with frequent bracket failure. However, 20 (40%) followed their appointments regularly.

Table-I:Plaque scoring index of the patients stratified to compliance variables.

Plaque Scoring Index	Mean ± SD
Total Plaque scoring index (PI), mean	67.5 ± 31.6
Mean PI in patients with frequent bracket failure	89.6 ± 8.12
Mean PI in patients with rare bracket failure	39.4 ± 27.8
Mean PI in patients who missed their follow-ups	88.8 ± 9.46
Mean PI in patients who did not miss their follow-ups	35.5 ± 25.6

Table-II:Compliance of patients in terms of bracket failure and following regular appointment follow-ups.

Compliance of patients	n (%)
Bracket failures	
Frequent	28 (56)
Rare	22 (44)
Regular appointment follow-ups	
Yes	20 (40)
No	30 (60)

A statistical analysis determined that there is a highly significant, strongly positive correlation between bracket failure rate and plaque scoring index (r = 0.796, P < 0.001), as demonstrated in Figure-I. This indicates that patients with a lower bracket failure rate tend to have lower mean plaque score indices.

A statistical analysis revealed a highly significant, strong negative correlation between the rate of appointment follow-ups and the plaque scoring index (r = -0.832, P value < 0.001), as illustrated in Figure-II. The results indicate that patients who had good attendance at follow-up appointments had lower mean plaque score indices.

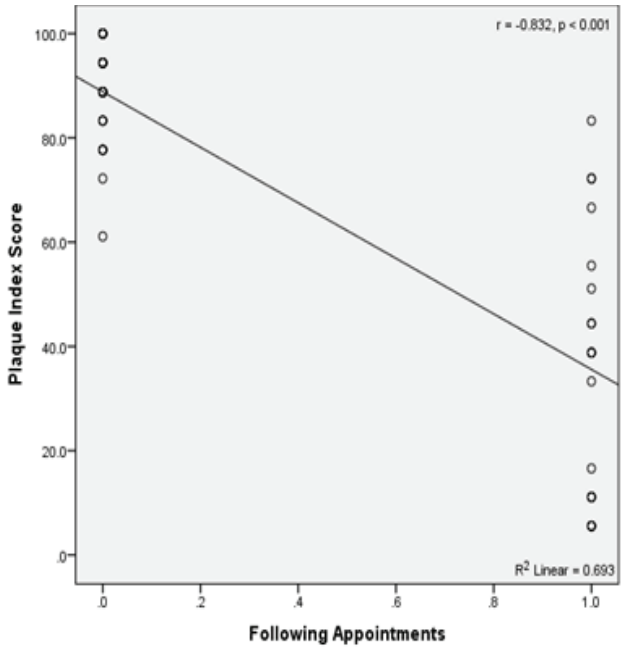

Figure-I: Correlation Figure between bracket failure rate and plaque scoring index.

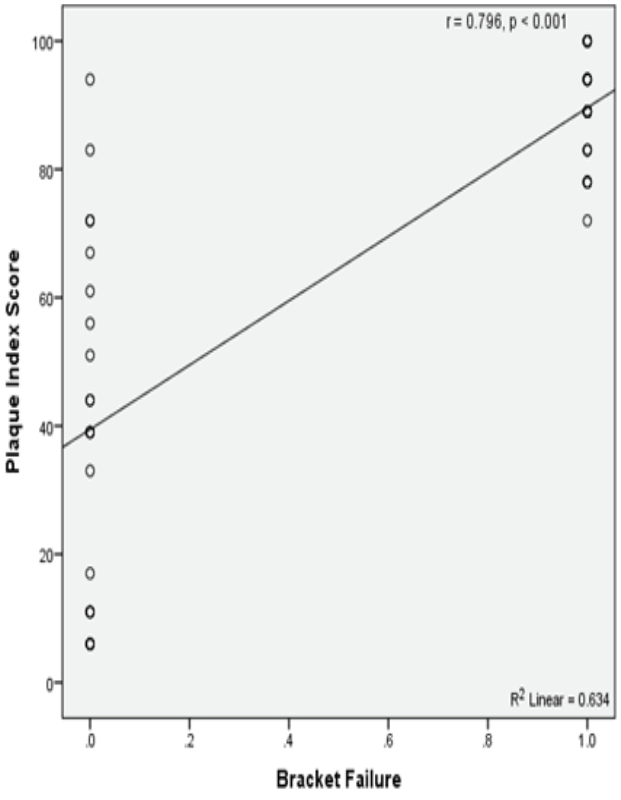

Figure-II:Correlation between rate of following appointments and plaque scoring index.

DISCUSSION

The present research showed a significant correlation between the attitude of patients towards their treatment and plaque accumulation. The findings imply that the patients who had a poor response to their treatment had a higher rate of bracket failure and a tendency to forget appointments, while the opposite was true for those with a more positive attitude.

In the stratified analysis of the data from this study, it was observed that those with higher plaque scoring index had higher mean bracket failures and higher rates of missing appointments follow-up. This indicates that a patient with a more positive outlook had a lower bracket failure rate and vice versa. To ensure successful orthodontic treatment, brackets must remain on the teeth for the duration of treatment. Thus, patients need to understand the importance of complying with instructions, while orthodontists must ensure that the bonding of brackets is done with their expertise.

Given the connections between orthodontic treatment and gingival health, cooperation between patients, orthodontists, and periodontists is essential. Orthodontic interventions can correct dental and skeletal issues, yet they can also lead to changes in oral hygiene practices and periodontal health. Orthodontic devices and techniques may cause soft tissue reactions in the gums, and their proximity to the gingival sulcus, the propensity to accumulate plaque, and the obstacles they present to good oral hygiene can make it hard to maintain good oral health while undergoing orthodontic care [15] .

The insertion of orthodontic appliances into the mouth can lead to chronic infection, excessive inflammation, irreversible loss of attachment (lasting bone diminishment), and gingival recession. There have been several references to the correlation between orthodontic tooth movement and gingival recession in both orthodontic and periodontal literature. Despite the level of plaque control, many individuals undergoing fixed orthodontic treatment still experience generalized gingivitis after a short period. Dental caries and periodontal disease result from oral microbiome interactions with host factors: diet influences caries, while the immune system affects periodontal disease [15,16]. Anterior irregularities worsen over time, resulting in diminished dental arch dimensions in both orthodontically treated and untreated patients [17]. Patients often experience mild to moderate gingivitis within 1-2 months of receiving orthodontic appliances. Liu, Sun, Dong, Lu, Zhou, and Hansen [18] further noted that fixed orthodontic treatment often leads to an increase in dental plaque and gingival inflammation, as indicated by a significant rise in the Plaque Index (PI) and Gingival Index (GI) shortly after treatment begins in comparison to the baseline. Ahalina, adhum num

In contrast to the findings of other studies, Davies, Shaw, Worthington, Addy, Dummer, and Kingdon [19] investigated the impacts of orthodontic treatment on plaque and gingivitis and determined that children who had undergone orthodontic treatment had lower levels of plaque and gingivitis compared to those who had not. The study concluded that scheduled visits to the orthodontist are likely responsible for improved oral hygiene and gingival health.

Bond failure is one of the inescapable issues in fixed orthodontics. The failure rate of brackets should not exceed 6% in proper therapeutic practice [20]. However, a systematic review revealed a frequency of 0.6-28.3% [21]. A bracket that failed and returned can lengthen the course of therapy by 0.3 to 0.6 months. Interproximal reduction (IPR) is now a key orthodontic procedure for creating space in various clinical cases in minimal duration [22,23]. According to Bukhari, Sohrabi, and Tavares [24] patient compliance to keep visits reduced by 23% for every 6 months of additional treatment duration. As a result, both for the patient and the orthodontic office, the cost of the treatment is significantly raised [20].

The incidence of bond failure may be influenced by a variety of patient-related elements, such as the pre-existing condition of enamel or dentine, age [25,26] compliance of a patient towards treatment, oral hygiene, anterior or posterior teeth occlusal relationship, and overbite.

In our study compliance of a patient was assessed by monitoring two variables simultaneously (at 3rd, 4th, or 5th appointment after the placement of brackets). One was the backer failure rate (frequent or rare) and the other was to observe whether the patient was keen to follow his or her appointments or not. Plaque scoring in the bonded lower anterior segment of the patient was done by using the plaque index.

The results that were obtained in this study indicate that there is a strong negative correlation between the rate of following appointment follow-ups and plaque scoring index and a strong positive between bracket failure rate and plaque scoring index. Therefore, patients who have a low bracket failure rate and who regularly attend their follow-up appointments are more likely to have a low plaque score index, and patients who are more concerned with maintaining good oral hygiene are more likely to attend their scheduled appointments and take better care of their brackets. This may imply that higher levels of compliance are linked to improved oral hygiene as well as dental health.

Consistent with previous research,[18,25]this study demonstrated that better oral hygiene was associated with greater treatment adherence in orthodontics. Patients are more likely to adhere to their orthodontic treatment plan if they maintain proper oral hygiene. Patients who adhere well to their treatment are likely to be more consistent with attending follow-up appointments. Both internal and external motivation significantly impact achieving excellent dental hygiene and successful treatment results.

Overall, these findings suggest that improvement in oral hygiene may be linked to patient compliance with orthodontic treatment. To achieve the best results, orthodontists must emphasize to their patients the importance of adhering to their treatment plan and attending all scheduled follow-up appointments.

CONCLUSION

In conclusion, this study shows that the percentage of failed brackets, the percentage of patients who kept their follow-up appointments, and the plaque score index are all negatively correlated. Patients who have a low bracket failure rate as well as those who consistently attend follow-up appointments are more likely to have low plaque scores, according to the study findings. Therefore, doctors should consider patient compliance as a crucial factor in the success of their treatment.

ACKNOWLEDGEMENT: None.
CONFLICT OF INTEREST: None.
GRANT SUPPORT AND FINANCIAL DISCLOSURE: None.

REFERENCES:

1. Marincak Vrankova Z, Rousi M, Cvanova M, Gachova D, Ruzicka F, Hola V, et al. Effect of fixed orthodontic appliances on gingival status and oral microbiota: a pilot study. BMC Oral Health. 2022;22(1):455. Doi:10.1186/s12903-022-02511-9
2. Al-Anezi SA, Harradine NW. Quantifying plaque during orthodontic treatment: a systematic review. The Angle Orthodontist.2012;82(4):748-753. Doi:10.2319/050111-312.1
3. Proffit WR, Fields H, Larson B, Sarver DM. Contemporary orthodontics-e-book: Elsevier Health Sciences; 2018.
4. Mathew R, Sathasivam HP, Mohamednor L, Yugaraj P. Knowledge, attitude and practice of patients towards orthodontic treatment. BMC Oral Health. 2023;23(1):132 Doi: 10.1186/s12903-023-02780-y.
5. Aikins EA, Ututu C. An audit of bonding failure among orthodontic patients in a tertiary hospital in South-South Nigeria. International Journal of Orthodontic Rehabilitation.2017;8(3):91-95.Doi:10.4103/ijor.ijor_17_17
6. AL-Duliamy MJ. The effect of oral hygiene status on the bond failure rate of the orthodontic bracket. Journal of Oral and Dental Research. 2018;5(2):2-12.
7. Santos M, de Araujo Almeida G, Normando D. The impact of the COVID-19 pandemic on total treatment time of fixed appliances. Progress in Orthodontics. 2022;23(1):42. Doi:10.1186/s40510-022-00437-0
8. Packer M, Anker SD, Butler J, Filippatos G, Pocock SJ, Carson P, et al. Cardiovascular and renal outcomes with empagliflozin in heart failure. New England Journal of Medicine. 2020;383(15):1413-1424. Doi: 10.1056/NEJMoa2022190
9. Ernest MA, Adegbite K, Yemitan T, Adeniran A. Orthodontic treatment motivation and cooperation: A cross-sectional analysis of adolescent patients' and parents' responses. journal of orthodontic science. 2019;8(1):12. DOI: 10.4103/jos.JOS_36_17
10. Geoghegan F, Birjandi AA, Machado Xavier G, DiBiase AT. Motivation, expectations, and understanding of patients and their parents seeking orthodontic treatment in specialist practice. Journal of Orthodontics. 2019;46(1):46-50. Doi:10.1177/1465312518820330
11. Rojas S, Cárdenas J, Sierra A, Rojas D, ROJAS S, CÁRDENAS J, et al. Cooperation during orthodontic treatment of patients with i phase and phase orthodontic treatment. International Journal of Odontostomatology. 2021;15(2):526-531.Doi:1110.4067/S0718-381X2021000200526
12. Coppola G, Christopoulou I, Gkantidis N, Verna C, Pandis N, Kanavakis G. The effect of orthodontic treatment on smile attractiveness: a systematic review. Progress in Orthodontics. 2023;24(1):4.Doi: 10.1186/s40510-023-00456-5
13. Attin R, Thon C, Schlagenhauf U, Werner C, Wiegand A, Hannig C, et al. Recolonization of mutant steptococci on teeth with orthodontic appliances after antimicrobial therapy. The European Journal of Orthodontics. 2005;27(5):489-493. Doi:10.1093/ejo/cji018
14. Bock NC, Von Bremen J, Kraft M, Ruf S. Plaque control effectiveness and handling of interdental brushes during multibracket treatment—a randomized clinical trial. The European Journal of Orthodontics. 2010;32(4):408-413. Doi:10.1093/ejo/cjp088
15. Valm AM. The Structure of Dental Plaque Microbial Communities in the Transition from Health to Dental Caries and Periodontal Disease. Journal of Molecular Biology.2019;431(16):2957-2969.Doi:10.1016/j.jmb.2019.05.016
16. Abdelhafez RS, Talib AA, Al-Taani DS. The effect of orthodontic treatment on the periodontium and soft tissue esthetics in adult patients. Clinical and Experimental Dental Research. 2022;8(1):410-420. Doi:10.1002/cre2.480
17. Gambardela-Tkacz CM, Alcaraz G, Cotrin P, de Freitas KM, Moura W, Janson G, Garib D, de Freitas MR. Incisor irregularity and dental arch dimensions change in subjects with different severity of anterior crowding: a 37-year follow-up. Progress in Orthodontics. 2023;24(1):2-10. Doi:10.1186/s40510-023-00461-8
18. 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. The Angle Orthodontist. 2011;81(4):609-615. Doi:10.2319/082310-352.1
19. Davies TM, Shaw WC, Worthington HV, Addy M, Dummer P, Kingdon A. The effect of orthodontic treatment on plaque and gingivitis. American Journal of Orthodontics and Dentofacial Orthopedics.1991;99(2):155-161. Doi:10.1016/0889-5406(91)70118-G

20. Brown K. The impact of bonding material on bracket failure rate. Vital. 2009;6(4):28-30. Doi:10.1038/vital1039
21. Almosa N, Zafar H. Incidence of orthodontic brackets detachment during orthodontic treatment: A systematic review. Pakistan Journal of Medical Sciences. 2018;34(3):744-750. Doi:10.12669/pjms.343.15012
22. Gazzani F, Bellisario D, Fazi L, Balboni A, Licoccia S, Pavoni C, et al. Effects of IPR by mechanical oscillating strips system on biological structures: a quantitative and qualitative evaluation. Progress in Orthodontic. 2023;24(1):9. Doi:10.1186/s40510-023-00460-9
23. Stasinopoulos D, Papageorgiou SN, Kirsch F, Daratsianos N, Jäger A, Bourauel C. Failure patterns of different bracket systems and their influence on treatment duration: a retrospective cohort study. The Angle Orthodontist. 2018;88(3):338-347. Doi:10.2319/081817-559.1
24. Bukhari OM, Sohrabi K, Tavares M. Factors affecting patients' adherence to orthodontic appointments. American Journal of Orthodontics and Dentofacial Orthopedics. 2016;149(3):319-324. Doi:10.1016/j.ajodo.2015.07.040
25. Barbosa IV, Ladewig VD, Almeida-Pedrin RR, Cardoso MA, Santiago Junior JF, Conti AC. The association between patient's compliance and age with the bonding failure of orthodontic brackets: a cross-sectional study. Progress in Orthodontics. 2018;19(1):1-5. Doi:10.1186/s40510-018-0209-1
26. Sukhia RH, Sukhia HR, Azam SI, Nuruddin R, Rizwan A, Jalal S. Prediction of bracket detachment rate in orthodontics: retrospective cohort study. International Orthodontics. 2019;17(2):208-15. Doi: 10.1016/j.ortho.2019.03.002

Submitted for publication: 13-06-2023
Accepted after revision: 24-08-2024

Authors' Contribution:

***Hafsa Riaz*:** Design of the work, the acquisition, analysis, and interpretation of data for the work..
Maria Tanveer: Drafting the work and reviewing it critically for important intellectual content.