



COMPARATIVE EVALUATION OF DIFFERENT ORAL HYGIENE PROTOCOLS: PERIODIC SCALING VERSUS REGULAR BRUSHING IN PATIENTS WITH FIXED ORTHODONTIC APPLIANCE - A PROSPECTIVE COHORT STUDY

Orthodontics

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ABSTRACT

INTRODUCTION: Fixed orthodontic appliances impede correct periodontal hygiene, resulting in more plaque accumulation, inflammation, and bleeding. **AIM:** To evaluate the effectiveness of oral hygiene protocols in patient periodontal health with fixed orthodontic appliance. **METHOD:** 45 adolescent patients were divided into 3 groups (Group 1- Patients practicing regular brushing with orthodontic toothbrush. Group 2- Patients practicing regular brushing of teeth with powered toothbrush Group3- Patients practicing regular brushing of teeth with orthodontic toothbrush and scaling once per 3 months). Subgingival scaling was done in all the patients before starting fixed orthodontic treatment. After 3 months of practicing different oral hygiene protocols, scaling was done in Group 3, 21 days post scaling clinical parameters was taken and salivary sample was collected for estimation of AST level as a baseline parameter(T0). Which was repeated after 3 months as T1 and again for T2. **RESULT:** The results consistently demonstrated that patients undergoing scaling once every 3 months exhibited the least plaque accumulation, gingival inflammation, and better oral hygiene compared to those using powered or ortho toothbrushes. The AST levels, a marker for potential systemic inflammation, also followed a similar pattern, with the least levels observed in patients undergoing regular scaling. **CONCLUSION:** This results suggested that the frequency of scaling plays a pivotal role in maintaining oral health during fixed orthodontic treatment.

KEYWORDS

INTRODUCTION

Orthodontic treatment, often involving the use of fixed appliances such as braces, has become increasingly prevalent in modern dentistry. While these orthodontic interventions offer a promising solution for correcting malocclusions and enhancing dental aesthetics, they also present unique challenges in terms of oral hygiene maintenance. Patients with fixed orthodontic appliances face an increased risk of plaque accumulation, gingival inflammation, and dental caries due to the intricate nature of brackets, wires, and bands, which can create areas that are difficult to clean thoroughly¹. If the plaque around brackets is not controlled, attachment loss and alveolar bone resorption occur, that will influence tooth movement and orthodontic treatment efficacy².

Periodontal scaling, a dental procedure aimed at removing dental calculus and bacterial biofilm from tooth surfaces, is a well-established intervention for managing periodontal diseases and maintaining overall oral health³. For patients with gingivitis without orthodontic appliances, periodontal scaling every 6-12 months effectively maintains periodontal health².

The exploration of Aspartate Aminotransferase (AST) in saliva as a potential biomarker for soft tissue destruction in the periosteum is a promising development in the field of oral diagnostics⁴. While further research is needed to solidify its clinical utility, the possibility of non-invasively monitoring periosteal health through salivary AST holds great potential for enhancing the early detection and management of periodontal diseases.

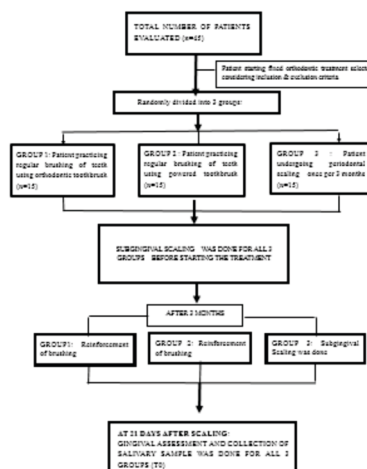
This study aims to bridge existing knowledge gaps by rigorously examining and comparing the impact of different oral hygiene protocols in patients with fixed orthodontic appliances.

MATERIAL AND METHOD

This study comprised 45 adolescent patients (22 males and 23 females), between the ages of 11 to 18, who reported to the Department of Orthodontics and Dentofacial Orthopedics at ITS Dental College for fixed orthodontic treatment in Greater Noida. Written informed consent was obtained from the parents of the adolescents patient, and patients were randomly divided into 3 groups of 15 adolescents per group using random number calculator. Group 1- Patients practicing regular brushing with orthodontic toothbrush as a control group. Group 2- Patients practicing regular brushing of teeth with powered toothbrush. Group3- Patients practicing regular brushing of teeth with orthodontic toothbrush and periodontal scaling once per 3 months.

Patient with no history of systemic disease and were in good general health within the age group 11-18 years were included in the study. Patients with active periodontal disease, oral mucosal disease and patients treated with antibiotics or hormonal therapy within one month before experiment, history of taking drugs causing gingival enlargement and patient with tobacco chewing and smoking habit were excluded. Pregnant patients or lactating women were also excluded from the study.

Subgingival scaling was done in all the patients before starting fixed orthodontic treatment. After three months of practicing different oral hygiene protocol, scaling was done for Group three, and 21 days after scaling baseline parameter (T0) Plaque Index (Silness and Loe), Gingival Index (Loe and Silness), oral hygiene index (OHI) by John C Greene and Jack R Vermillion were taken and 10ml salivary sample were collected in a sterile eppendorf tubes after the patients were asked to rinse the mouth with 15.0 ml of distilled water to wash out exfoliated cells for estimation of AST level. After three months from T0 scaling was repeated for group three and 21 days post scaling clinical parameters was taken and salivary sample was collected as T1. Again after three months from T1 scaling was repeated for group three and 21 days post scaling clinical parameters was done and salivary sample was collected as T2. The salivary samples were sent to the laboratory for estimation of AST level.



GROUPS	Sample size	Mean	Standard deviation	P-value
Patient using powered toothbrush	15	1.563	0.1999	0.00124,s
Patient using orthodontic toothbrush	15	1.097	0.194	0.00124,s
Patient undergoing scaling once per 3 months	15	0.986	0.159	0.00124,s
There is a statistical significant difference across groups at 5% level of confidence				

The result indicates that least Gingival inflammation is seen in patients undergoing scaling once 3 months, followed by patients using orthodontic toothbrush and highest Gingival inflammation is seen in patients using powered toothbrush.

TABLE 15: Comparison between the 3 groups for OHI-S index at T1

GROUPS	Sample size	Mean	Standard deviation	P-value
Patient using powered toothbrush	15	4.426	0.273	0.00196,s
Patient using orthodontic toothbrush	15	3.59	0.2	0.00196,s
Patient undergoing scaling once per 3 months	15	3.207	0.207	0.00196,s
There is a statistical significant difference across groups at 5% level of confidence				

The result indicates that least OHI-S Index is seen in patients undergoing scaling once 3 months, followed by patients using orthodontic tooth brushes and highest OHI-S Index is seen in patients using powered toothbrush

TABLE 16: Comparison between the 3 groups for salivary aspartate aminotransferase at T1

GROUPS	Sample size	Mean	Standard deviation	P-value
Patient using powered toothbrush	15	54.27	2.058	0.0045,s
Patient using orthodontic toothbrush	15	36.24	2.149	0.0045,s
Patient undergoing scaling once per 3 months	15	29.06	2.897	0.0045,s
There is a statistical significant difference across groups at 5% level of confidence				

The result indicates that least AST level is seen in patients undergoing scaling once 3 months, followed by patients using orthodontic tooth brushes and highest AST level is seen in patients using powered toothbrush.

Scaling was done for group 3 (patients practicing regular brushing of teeth with orthodontic toothbrush) after 3 months from T1 and after 21 days from scaling clinical evaluation was done for all the groups and salivary sample was collected.

TABLE 17: Comparison between the 3 group for Plaque index (PI) at T2

GROUPS	Sample size	Mean	Standard deviation	P-value
Patient using powered toothbrush	15	3.016	0.27	0.00,s
Patient using orthodontic toothbrush	15	1.833	0.20	0.00,s

Patient undergoing scaling once per 3 months	15	1.483	0.25	0.00,s
There is a statistical significant difference across groups at 5% level of confidence				

The result indicates the least Plaque accumulation is seen in patients undergoing scaling once 3 months, followed by patients using orthodontic toothbrush and highest plaque accumulation is seen in patients using powered toothbrush.

TABLE 18: Comparison between the 3 group for Gingival index (GI) at T2

GROUPS	Sample size	Mean	Standard deviation	P-value
Patient using powered toothbrush	15	1.8993	0.2115	0.00,s
Patient using orthodontic toothbrush	15	0.8853	0.1503	0.00,s
Patient undergoing scaling once per 3 months	15	0.7506	0.2428	0.00,s
There is a statistical significant difference across groups at 5% level of confidence				

The result indicates the least Gingival inflammation is seen in patients undergoing scaling once 3 months, followed by patients using orthodontic toothbrush and highest Gingival inflammation is seen in patients using powered toothbrush.

TABLE 19: Comparison between the 3 group for OHI-S index at T2

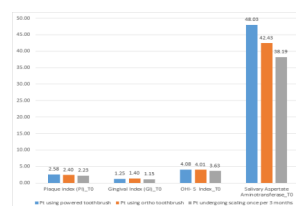
GROUPS	Sample size	Mean	Standard deviation	P-value
Patient using powered toothbrush	15	4.993	0.296	0.0015,s
Patient using orthodontic toothbrush	15	3.166	0.201	0.0015,s
Patient undergoing scaling once per 3 months	15	2.358	0.336	0.0015,s
There is a statistical significant difference across groups at 5% level of confidence				

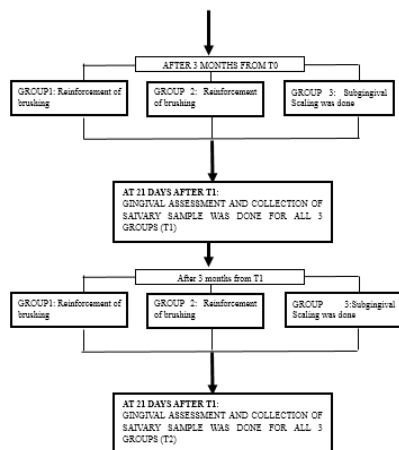
The result indicates the least OHI-S Index is seen in patients undergoing scaling once 3 months followed by patients using orthodontic tooth brushes and highest OHI-S Index is seen in patients using powered toothbrush.

TABLE 20: Comparison between the 3 group for salivary aspartate aminotransferase at T2

GROUPS	Sample size	Mean	Standard deviation	P-value
Patient using powered toothbrush	15	58.03	2.327	0.0038,s
Patient using orthodontic toothbrush	15	31.86	2.064	0.0038,s
Patient undergoing scaling once per 3 months	15	24.38	3.159	0.0038,s
There is a statistical significant difference across groups at 5% level of confidence				

The result indicates the least AST level is seen in patients undergoing scaling once 3 months, followed by patients using orthodontic tooth brushes and highest AST level is seen in patients using powered toothbrush.





STATISTICAL ANALYSIS

Data was analysed using Statistical Package for Social Sciences (SPSS) version 27. Categorical variables was summarized as frequency. Continuous variables was summarized as Means & Standard Deviation. Graphs was prepared on Microsoft Excel.

ETHICAL APPROVAL AND CONFIDENTIALITY

The data were collected anonymously and retained no identifying information. When the data were collected, we applied the inclusion and exclusion criteria. Then, the data were entered into an Excel file. Ethical approval was taken from ITS DENTAL COLLEGE HOSPITAL AND RESEARCH CENTRE INSTITUTIONAL ETHICS COMMITTEE (IEC) Ref no: IEC/ORTHO/1/21

RESULTS

Scaling was done for all the three groups after three months of fixed orthodontic treatment and after 21 days from scaling clinical evaluation was done for all the groups and salivary sample was collected and baseline parameters was made.

TABLE 9: Comparison between the 3 group for Plaque index (PI) at T0

GROUPS	Sample size	Mean	Standard deviation	P-value
Patient using powered toothbrush	15	2.58	0.26	0.0023,s
Patient using orthodontic toothbrush	15	2.4	0.22	0.0023,s
Patient undergoing scaling once per three months	15	2.23	0.27	0.0023,s
There is a statistical significant difference across groups at 5% level of confidence				

As the result indicates, the least Plaque accumulation is seen in patients undergoing scaling once per 3 months, followed by patients using orthodontic toothbrushes and highest Plaque accumulation is seen in patients using powered toothbrush.

TABLE 10: Comparison between the 3 group for Gingival index (GI) at T0

GROUPS	Sample size	Mean	Standard deviation	P-value
Patient using powered toothbrush	15	1.45	0.17	0.00005,s
Patient using orthodontic toothbrush	15	1.4	0.21	0.00005,s
Patient undergoing scaling once per 3 months	15	1.152	0.13	0.00005,s
There is a statistical significant difference across groups at 5% level of confidence				

As the result indicates, the least Gingival inflammation is seen in patients undergoing scaling once per 3 months, followed by patients using orthodontic toothbrushes and highest Gingival inflammation is seen in patients using powered toothbrush.

TABLE 11: Comparison between the 3 groups for OHI-S index at T0

GROUPS	Sample size	Mean	Standard deviation	P-value
Patient using powered toothbrush	15	4.082	0.16	0.00,s
Patient using orthodontic toothbrush	15	4.008	0.15	0.00,s
Patient undergoing scaling once per 3 months	15	3.63	0.185	0.00,s
There is a statistical significant difference across groups at 5% level of confidence				

As the result indicates, the least OHI-S Index is seen in patients undergoing scaling once per 3 months, followed by patients using orthodontic toothbrushes and highest OHI-S Index is seen in patients using powered toothbrush

TABLE 12: Comparison between the 3 group for Salivary Aspartate Aminotransferase at T0

GROUPS	Sample size	Mean	Standard deviation	P-value
Patient using powered toothbrush	15	48.03	1.6102	0.0031,s
Patient using orthodontic toothbrush	15	42.42	1.897	0.0031,s
Patient undergoing scaling once per 3 months	15	38.18	1.785	0.0031,s
There is a statistical significant difference across groups at 5% level of confidence				

As the result indicates the least AST level is seen in patients undergoing scaling once per 3 months followed by patients using orthodontic toothbrushes and highest AST level is seen in patients using powered toothbrush.

Scaling was done for group 3 (patients practicing regular brushing of teeth with orthodontic toothbrush) after 3 months from T0 and after 21 days from scaling clinical evaluation was done for all the groups and salivary sample was collected.

TABLE 13: Comparison between the 3 groups for plaque index (PI) at T1

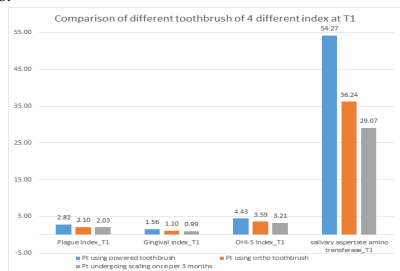
GROUPS	Sample size	Mean	Standard deviation	P-value
Patient using powered toothbrush	15	2.816	0.2402	0.00,s
Patient using orthodontic toothbrush	15	2.1	0.2275	0.00,s
Patient undergoing scaling once per 3 months	15	2.03	0.2084	0.00,s
There is a statistical significant difference across groups at 5% level of confidence				

The result indicates that least Plaque accumulation is seen in patients undergoing scaling once 3 months, followed by patients using orthodontic toothbrushes and highest plaque accumulation is seen in patients using powered toothbrush.

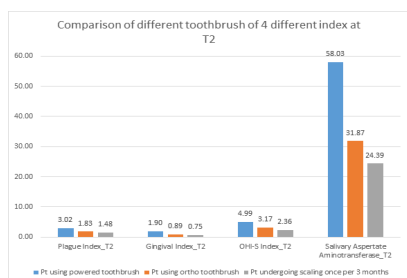
TABLE 14: Comparison between the 3 groups for gingival index (GI) at T1

Graph 1: Comparison of PI, GI, OHI-S index and AST level taken at T0

As the graph indicates patients using powered toothbrush shows highest Plaque Index(PI), Gingival Index(GI), OHI-S and AST level followed by patients practicing orthodontic toothbrush and least indices and AST level is seen in patients undergoing scaling once per 3 months.

**Graph 2:** Comparison of PI, GI, OHI-S index and AST level taken at T1

As the graph indicates patients using powered toothbrush shows highest Plaque Index(PI), Gingival Index(GI), OHI-S and AST level followed by patients practicing orthodontic toothbrush and least indices and AST level is seen in patients undergoing scaling once per 3 months.

**Graph 3:** Comparison of PI, GI, OHI-S index and AST level taken at T2

As the graph indicates patients using powered toothbrush shows highest Plaque Index(PI), Gingival Index(GI), OHI-S and AST level followed by patients practicing orthodontic toothbrush and least indices and AST level is seen in patients undergoing scaling once per 3 months.

Orthodontic treatment is a potentially regarded risk factor for periodontal disease due to possibilities of orthodontic appliances hindering thorough oral hygiene practices and fostering bacterial build up⁵. Maintaining good dental hygiene becomes crucial, particularly with fixed orthodontic appliances, as they can facilitate plaque accumulation, leading to symptoms like gingival swelling and bleeding gums⁷.

Brushing is the most crucial technique for preventing plaque buildup in the oral cavity, particularly around tooth surfaces. Research by Sarutichart et al⁷, has demonstrated that mechanical cleaning is still necessary to remove plaque, particularly in the vicinity of bonded brackets.

Previous research has explored various factors related to oral hygiene, including brushing technique, duration, and the use of mouthwashes. Borutta et al⁹, Silvestrini Biavati et al¹⁰, and Barnes et al¹¹, conducted studies indicating that powered or electric toothbrushes are associated better results of plaque removal. Erbe et al¹², drew comparisons between regular and orthodontic toothbrushes, noting the superior design of orthodontic brushes for better adaptation around fixed orthodontic appliances.

However, not all studies found significant differences among toothbrush types. Costa et al¹³, found no statistical distinction in clinical and microbiological parameters among ultrasonic, electric, and manual toothbrushes. Recent research by Lancen Ousehal et al¹⁴, indicated that orthodontic toothbrushes reduced plaque scores compared to conventional ones.

In a study by Ristic et al¹⁴, it was observed that the Gingival Index (GI) gradually increased at 4 weeks and 3 months after the initiation of wearing a fixed appliance, reaching its peak value at 6 months. Similarly, other researchers have noted that the development of gingivitis peaks after wearing a fixed appliance for 5 to 6 months.

The study revealed that regular subgingival scaling is most effective in minimizing plaque accumulation, while orthodontic toothbrushes demonstrated superior cleaning efficacy compared to powered toothbrushes across various evaluation timelines, both clinically and biochemically. Interestingly, the study contradicts findings by Cirelli et al¹⁵, which compared electric, ultrasonic, and regular toothbrushes and concluded that ultrasonic and electric variants were more effective in biofilm removal than regular toothbrushes. Similarly, Borutta et al⁹, 2002 compared powered toothbrushes with manual toothbrushes, revealing superior plaque removal and reduction in gingival inflammation with powered toothbrushes. The disparity in results could potentially be attributed to differences in bristle arrangement, rotational motion, and battery type among the powered toothbrush brands utilized in these studies, which may influence their efficacy.

This study is in line with the study by R Rebekah and R Navaneethan 2023¹⁶, who found that when orthodontic patients used orthodontic toothbrushes instead of conventional or powered toothbrushes, the results showed a statistically higher degree of teeth cleaning effectiveness. In a study published in 2023, Ama Johal¹⁷ examined how well powered and manual toothbrushes controlled plaque and gingival health in individuals receiving fixed orthodontic treatment and found that periodontal health indices and plaque control drastically deteriorated throughout the course of the 12-month follow-up period: although there were not any differences between using powered and manual toothbrushes to maintain gingival health and reduce plaque. In a systematic review published in 2021, Marcal FF et al¹⁸, compared the effectiveness of orthodontic and conventional toothbrushes in reducing plaque and gingival index. They concluded that using an orthodontic toothbrush was more effective in improving plaque index than using a conventional toothbrush.

AST levels were found to be lowest in patients undergoing regular scaling (Group 3) compared to those using orthodontic toothbrushes, with the highest levels observed in the powered toothbrush group. Jie Wei¹⁹ (2005) investigated the impact of brushing and scaling on periodontal health in individuals undergoing fixed orthodontic treatment, concluding that periodontal scaling effectively reduced plaque and preserved periodontal health. Additionally, Jiang C et al⁸, (2021) compared various periodic periodontal scaling protocols in adolescents with fixed orthodontic appliances, measuring levels of aspartate aminotransferase (AST) and alkaline phosphatase (ALP) in gingival crevicular fluid alongside periodontal clinical indexes. Their findings suggested that periodontal scaling enhanced oral hygiene in adolescents who undergo fixed orthodontic treatment, with monthly or three-monthly scaling protocols preferred over treatments administered every six months. Consequently, periodontal scaling not only maintained good oral hygiene during fixed orthodontic treatment but also expedited the restoration of periodontal health.

SUMMARY AND CONCLUSION

The results consistently demonstrated that least plaque accumulation, gingival inflammation, OHI-S Index and AST level is seen in patients undergoing scaling once every 3 months, followed by patients using orthodontic toothbrushes and highest in patients using powered toothbrush at different time interval T0, T1 and T2.

The findings underscore the importance of incorporating regular scaling into oral hygiene practices for individuals undergoing fixed orthodontic treatment. The study also highlights the limitations of relying solely on powered or orthodontic toothbrushes in achieving optimal oral health during orthodontic treatment. Further research may delve into the long-term effects and potential systemic benefits of maintaining optimal oral hygiene practices during orthodontic interventions.

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