

Original Research

Assessment of Oral Health Maintenance in Patients Undergoing Orthodontic Treatment: An Original Research

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ABSTRACT:

Background: Orthodontic treatment can significantly impact oral health maintenance, as it introduces challenges related to plaque accumulation and gingival inflammation. Understanding the effects of orthodontic treatment on oral health is crucial for improving patient care. **Methods:** In this prospective study, 500 patients undergoing orthodontic treatment were assessed over 24 months. Clinical examinations measured Plaque Index (PI) and Gingival Index (GI) scores at baseline and at 6, 12, and 24 months. Patient questionnaires evaluated oral hygiene practices and compliance. Statistical analyses were conducted to identify trends and correlations. **Results:** PI and GI scores consistently increased over time, indicating higher plaque accumulation and gingival inflammation. Patient compliance with recommended oral hygiene practices declined, with inadequate compliance rising from 55% to 68% over 24 months. Oral lesions and discomfort increased, reaching 20% and 32%, respectively, at 24 months. **Conclusion:** Orthodontic treatment is associated with increased plaque accumulation, gingival inflammation, and decreased patient compliance with recommended oral hygiene practices. This study emphasizes the importance of patient education, regular check-ups, interdental cleaning devices, and motivational support to enhance oral health maintenance during orthodontic treatment. Selecting appropriate orthodontic appliances is also essential, and patient collaboration is pivotal in achieving optimal oral health outcomes.

Keywords: Orthodontic treatment, oral health, maintenance, plaque accumulation, gingival inflammation.

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INTRODUCTION

Orthodontic treatment is a widely practiced dental specialty that focuses on correcting misaligned teeth and malocclusions to improve both oral function and aesthetic appearance. It involves the use of various orthodontic appliances, such as braces and aligners, to reposition teeth gradually over a specified period. The fundamental goal of orthodontics is to achieve proper dental alignment, thereby enhancing masticatory function, speech, and the overall quality of life for

individuals. While orthodontic treatment offers numerous benefits, it also presents unique challenges in terms of maintaining oral health, which is the central focus of this original research [1-3].

One of the most significant challenges during orthodontic treatment is the accumulation of dental plaque and the increased risk of gingival inflammation. This arises due to the presence of orthodontic appliances that create an intricate environment for bacterial colonization, making it

more difficult for patients to maintain optimal oral hygiene. Consequently, patients undergoing orthodontic treatment may be at an elevated risk for oral health issues, which could compromise the success of the treatment and the overall well-being of the patient [4-6].

Orthodontic appliances, including brackets, wires, bands, and elastics, create numerous niches and crevices where food particles can become trapped. These areas are particularly challenging to clean effectively, as traditional toothbrushes and floss may not reach all surfaces as easily as they would in a normal dentition. Consequently, dental plaque, a biofilm of bacteria and debris, can accumulate around orthodontic brackets and wires, potentially leading to dental caries, demineralization, and periodontal issues. Furthermore, as plaque accumulates, gingival tissues may become inflamed, a condition known as gingivitis, which can progress to more severe periodontal diseases if not addressed promptly [6-10]. The consequences of suboptimal oral health maintenance during orthodontic treatment are not limited to dental health. Poor oral hygiene can lead to discomfort for patients, causing sore spots and ulcers in the mouth. Moreover, complications may extend beyond the duration of orthodontic treatment, with lasting oral health problems impacting a patient's overall quality of life [1,7,10].

To mitigate these challenges and minimize the potential adverse effects of orthodontic treatment, it is essential to thoroughly assess the current status of oral health maintenance in patients undergoing such treatment. This research aims to comprehensively investigate the impact of orthodontic treatment on oral health and to identify effective strategies for its maintenance.

The complexity of this issue necessitates a multifaceted approach. To address these challenges, it is crucial to consider factors such as the type of orthodontic appliance used, the duration of treatment, patient compliance with recommended oral hygiene practices, and the role of patient education in improving oral health outcomes. By examining these factors in depth, we can gain a better understanding of how to enhance oral health maintenance during orthodontic treatment.

The significance of this research extends beyond individual patient care. Given the substantial number of individuals undergoing orthodontic treatment worldwide, the findings will have important implications for orthodontic practice and patient management. By identifying effective strategies to maintain oral health during orthodontic treatment, this research aims to enhance the overall experience of orthodontic patients and improve the long-term oral health outcomes, thus contributing to the broader field of dentistry.

MATERIALS AND METHODS

A comprehensive methodology was implemented to ensure the reliability and validity of our findings.

Sample Selection: A total of 500 patients undergoing orthodontic treatment were enrolled in this prospective study. Informed consent was obtained from all participants, and ethical approval was secured from the Institutional Review Board (IRB). The sample size was determined based on statistical power calculations to ensure adequate representation.

Clinical Examinations: Clinical examinations were conducted at four time points: baseline (prior to the initiation of orthodontic treatment) and subsequent assessments at 6, 12, and 24 months. The examinations were performed by experienced and calibrated dental professionals who were blinded to the patients' oral hygiene practices.

- **Plaque Index (PI):** Plaque accumulation was assessed using the Plaque Index (PI) introduced by Silness and L oe. PI scores were recorded on each tooth surface, and the average score per patient was calculated. The PI scale ranged from 0 (no plaque) to 3 (abundant plaque).
- **Gingival Index (GI):** Gingival inflammation was evaluated using the Gingival Index (GI) developed by L oe and Silness. GI scores were determined for each tooth, and the mean GI score per patient was calculated. The GI scale ranged from 0 (healthy) to 3 (severe inflammation).

Patient Questionnaires: Patient questionnaires were administered at each assessment point to evaluate oral hygiene practices and compliance with recommended oral care during orthodontic treatment. The questionnaire included inquiries about:

- Frequency of toothbrushing
- Use of dental floss or interdental brushes
- Use of mouthwash
- Any discomfort or oral lesions
- Dental clinic visits

Patient compliance was categorized as "adequate" if they reported following the orthodontist's instructions for oral hygiene care during treatment and "inadequate" if they did not.

Statistical Analysis: Data were analyzed using appropriate statistical methods to identify trends and correlations. Descriptive statistics, including means and standard deviations, were calculated for PI and GI scores at each assessment point. The significance of changes over time was assessed using repeated-measures analysis of variance (ANOVA), followed by post hoc tests with Bonferroni corrections.

Sample Calculation: To ensure the statistical power of the study, the sample size was determined based on the following parameters:

- Significance level (α) = 0.05
- Power ($1-\beta$) = 0.80
- Effect size = 0.25
- Number of assessment points = 4

Using the G*Power software, the required sample size was estimated as follows:

$N = \text{effect size} \times 2 \times (Z_{\alpha/2} + Z_{\beta})^2 \times 2 \times \text{variance} / \text{effect size}^2$
 Where:

- $Z_{\alpha/2}$ is the critical value for α
- Z_{β} is the critical value for $1 - \beta$

Given $\alpha = 0.05$, $\beta = 0.20$, an effect size of 0.25, and assuming a variance of 1, the estimated required sample size was 436. To account for potential attrition and ensure robust statistical power, we enrolled a total of 500 patients in our study.

This rigorous methodology allowed us to collect comprehensive data on oral health maintenance during orthodontic treatment and provided a strong foundation for the analysis and interpretation of our findings.

RESULTS

The Plaque Index (PI) scores showed a consistent upward trend over the 24-month assessment period. At baseline, the mean PI score was 1.2, indicating a moderate level of plaque accumulation. However, this increased to 2.3 at 24 months, signifying a substantial rise in plaque levels. This trend suggests that orthodontic treatment has a notable impact on plaque accumulation. Table 1

The Gingival Index (GI) scores also exhibited an upward trajectory during the study period. At

baseline, the mean GI score was 0.5, indicating healthy gingival conditions. However, by the 24-month assessment, the mean GI score had increased to 1.7, indicating the presence of moderate gingival inflammation. This suggests that orthodontic treatment is associated with a significant increase in gingival inflammation. Table 2

The data in Table 3 illustrate a declining trend in patient compliance with recommended oral hygiene practices during orthodontic treatment. At 6 months, 45% of patients reported adequate compliance, but this dropped to 32% at the 24-month assessment. In contrast, inadequate compliance increased from 55% at 6 months to 68% at 24 months. These findings highlight the challenges patients face in maintaining proper oral hygiene while undergoing orthodontic treatment. Table 3

Table 4 presents the prevalence of oral lesions and discomfort reported by patients during orthodontic treatment. The data show an increasing trend in the occurrence of oral lesions and discomfort. At 6 months, 15% of patients reported oral lesions, which increased to 20% at 24 months. Similarly, discomfort increased from 22% at 6 months to 32% at 24 months, indicating the challenges faced by patients during treatment. Table 4

Table 1: Plaque Index (PI) Scores Over Time

Assessment Point	Mean PI Score ± SD
Baseline	1.2 ± 0.4
6 months	1.7 ± 0.6
12 months	2.0 ± 0.7
24 months	2.3 ± 0.8

Table 2: Gingival Index (GI) Scores Over Time

Assessment Point	Mean GI Score ± SD
Baseline	0.5 ± 0.2
6 months	1.0 ± 0.4
12 months	1.3 ± 0.5
24 months	1.7 ± 0.6

Table 3: Patient Compliance with Oral Hygiene Practices

Assessment Point	Adequate Compliance (%)	Inadequate Compliance (%)
6 months	45%	55%
12 months	38%	62%
24 months	32%	68%

Table 4: Prevalence of Oral Lesions and Discomfort

Assessment Point	Oral Lesions (%)	Discomfort (%)
6 months	15%	22%
12 months	18%	27%
24 months	20%	32%

DISCUSSION

The results of this study shed light on the significant challenges and implications of oral health maintenance in patients undergoing orthodontic treatment. As discussed earlier, the findings revealed a substantial increase in plaque accumulation, gingival inflammation, and a decline in patient compliance

with recommended oral hygiene practices during the 24-month assessment period. In this section, we will elaborate on these findings, discuss their implications, and explore strategies to enhance oral health maintenance in orthodontic patients, while also drawing comparisons with relevant literature.

Impact of Orthodontic Treatment on Oral Health:

The increase in plaque accumulation and gingival inflammation observed in our study is consistent with previous research in the field. The presence of orthodontic appliances, such as brackets, wires, and bands, creates an intricate topography in the oral cavity, making it challenging for patients to maintain effective oral hygiene. This, in turn, results in a higher accumulation of dental plaque, which can lead to adverse oral health consequences, such as dental caries and periodontal issues [1,2, 6-10].

The findings from our study confirm that orthodontic treatment itself contributes to these issues, as indicated by the significant increase in Plaque Index (PI) and Gingival Index (GI) scores over the 24-month period. This underlines the need for vigilant oral health monitoring during orthodontic treatment and the implementation of measures to mitigate these adverse effects.

Patient Compliance and Its Role:

Our study also highlighted a decline in patient compliance with recommended oral hygiene practices over time. This decline in compliance could be attributed to various factors, including the difficulties associated with cleaning around orthodontic appliances and potential discomfort. Inadequate compliance, in turn, contributes to the worsening of oral health during orthodontic treatment.

Efforts to enhance patient compliance are crucial. Patient education plays a pivotal role in this regard. Orthodontists and dental professionals must provide clear and comprehensive instructions to patients on how to maintain proper oral hygiene while wearing orthodontic appliances. This includes guidance on toothbrushing techniques, the use of interdental cleaning devices, and the importance of regular dental check-ups. Patient motivation and ongoing support are essential to ensure that compliance remains high throughout the treatment period [3,7,9].

Our findings are consistent with previous studies that have highlighted the challenges of maintaining oral health during orthodontic treatment. Previous research reported an increase in plaque accumulation and gingival inflammation in orthodontic patients, in line with our results. These studies emphasize the need for vigilant monitoring and patient education to mitigate these issues.

Several studies have also explored the impact of different types of orthodontic appliances on oral health. Studies have compared patients with traditional braces and clear aligners, revealing that aligner patients tended to have better oral hygiene practices and lower plaque and gingival inflammation levels. Our study, while not focusing on appliance types, aligns with these findings, emphasizing the importance of selecting orthodontic appliances that are conducive to maintaining oral hygiene.

Strategies for Enhanced Oral Health Maintenance:

To address the challenges highlighted by our research and the existing literature, several strategies can be

employed to enhance oral health maintenance in orthodontic patients:

- 1. Patient Education:** Comprehensive patient education is paramount. Orthodontists and dental professionals should provide patients with detailed information on proper oral hygiene practices and the specific challenges posed by orthodontic appliances. This education should commence at the beginning of treatment and continue throughout its duration.
- 2. Regular Dental Check-ups:** Frequent dental check-ups are essential for early detection and intervention in oral health issues. Patients should be encouraged to maintain their regular dental appointments, and orthodontic clinics can coordinate with general dentists to ensure a collaborative approach to patient care.
- 3. Interdental Cleaning Devices:** Recommending and teaching patients how to use interdental cleaning devices, such as floss and interdental brushes, can be valuable in removing plaque from hard-to-reach areas around orthodontic appliances.
- 4. Motivational Support:** Patients benefit from motivation and support in maintaining good oral hygiene. Encouraging patients to track their progress, offering rewards for compliance, and providing guidance for addressing common issues like discomfort or oral lesions can bolster their commitment to oral health maintenance.
- 5. Appliance Selection:** The choice of orthodontic appliances should be considered carefully. Aligners may be a preferable option for patients who prioritize easier oral hygiene maintenance. Orthodontists can discuss appliance choices with patients based on their individual needs and preferences.

CONCLUSION

In conclusion, the findings of our research and the collective evidence from the literature emphasize the importance of addressing oral health maintenance during orthodontic treatment. The increase in plaque accumulation, gingival inflammation, and the decline in patient compliance underscore the challenges patients face. It is imperative for orthodontists, dental professionals, and patients to collaborate closely to mitigate these challenges and ensure optimal oral health outcomes during orthodontic treatment. By implementing effective strategies and interventions, we can improve the patient experience, promote better oral health, and ultimately enhance the success of orthodontic treatments.

REFERENCES

1. Kim HN, Han DH, Jun EJ, Kim SY, Jeong SH, Kim JB. The decline in dental caries among Korean children aged 8 and 12 years from 2000 to 2012 focusing SiCIndex and DMFT. *BMC Oral Health*. 2016 Mar 22;16:38. doi:10.1186/s12903-016-0188-x. PMID: 27001173; PMCID: PMC4802823.

2. Msyamboza KP, Phale E, Namalika JM, Mwase Y, Samonte GC, Kajirime D, Sumani S, Chalila PD, Potani R, Mwale GC, Kathyola D, Mukiwa W. Magnitude of dental caries, missing and filled teeth in Malawi: National Oral Health Survey. *BMC Oral Health*. 2016 Mar 9;16:29. doi: 10.1186/s12903-016-0190-3. PMID: 26956884; PMCID: PMC4784360.
3. Dođramacı EJ, Brennan DS. The influence of orthodontic treatment on dental caries: An Australian cohort study. *Community Dent Oral Epidemiol*. 2019 Jun;47(3):210-216. doi: 10.1111/cdoe.12446. Epub 2019 Jan 17. PMID: 30656705.
4. Bahannan SA, Elteley SM, Hassan MH, Ibrahim SS, Amer HA, El Meligy OA, Al-Johani KA, Kayal RA, Mokeem AA, Qutob AF, Mira AI. Oral and Dental Health Status among Adolescents with Limited Access to Dental Care Services in Jeddah. *Dent J (Basel)*. 2018 May 17;6(2):15. doi: 10.3390/dj6020015. PMID: 29794969; PMCID: PMC6023431.
5. de Silva AM, Hegde S, Akudo Nwagbara B, Calache H, Gussy MG, Nasser M, Morrice HR, Riggs E, Leong PM, Meyenn LK, Yousefi-Nooraie R. WITHDRAWN: Community-based population-level interventions for promoting child oral health. *Cochrane Database Syst Rev*. 2016 Dec 22;12(12):CD009837. doi: 10.1002/14651858.CD009837.pub3. PMID: 28004389; PMCID: PMC6463845.
6. de Silva AM, Hegde S, Akudo Nwagbara B, Calache H, Gussy MG, Nasser M, Morrice HR, Riggs E, Leong PM, Meyenn LK, Yousefi-Nooraie R. Community-based population-level interventions for promoting child oral health. *Cochrane Database Syst Rev*. 2016 Sep 15;9(9):CD009837. doi: 10.1002/14651858.CD009837.pub2. Update in: *Cochrane Database Syst Rev*. 2016 Dec 22;12:CD009837. PMID: 27629283; PMCID: PMC6457580.
7. Reddy ER, Rani ST, Manjula M, Kumar LV, Mohan TA, Radhika E. Assessment of caries status among school children according to decayed-missing-filled teeth/decayed-extract-filled teeth index, International Caries Detection and Assessment System, and Caries Assessment Spectrum and Treatment criteria. *Indian J Dent Res*. 2017 Sep-Oct;28(5):487-492. doi: 10.4103/ijdr.IJDR_735_16. PMID: 29072208.
8. Drachev SN, Brenn T, Trovik TA. Dental caries experience and determinants in young adults of the Northern State Medical University, Arkhangelsk, North-West Russia: a cross-sectional study. *BMC Oral Health*. 2017 Nov 28;17(1):136. doi: 10.1186/s12903-017-0426-x. PMID: 29183304; PMCID: PMC5706395.
9. Makkar A, Indushekar KR, Saraf BG, Sardana D, Sheoran N. A cross sectional study to evaluate the oral health status of children with intellectual disabilities in the National Capital Region of India (Delhi-NCR). *J Intellect Disabil Res*. 2019 Jan;63(1):31-39. doi: 10.1111/jir.12553. Epub 2018 Oct 18. PMID: 30338591.
10. Ulu Güzel KG, Akyıldız M, Dođusal G, Keleş S, Sönmez I. Evaluation of oral health status of children in pretreatment and after treatment for 18 months. *Cent Eur J Public Health*. 2018 Sep;26(3):199-203. doi: 10.21101/cejph.a5079. PMID: 30419622.