

# Exploring the Theoretical Relationship Between Orthodontic Treatment and Dental Decay in Epidemic Scenarios

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## Abstract

This study explores the relationship between orthodontic treatment and dental decay during epidemic scenarios, focusing on the challenges faced by patients with orthodontic appliances. Epidemic restrictions disrupt regular dental care, increasing the risk of dental health issues, particularly for orthodontic patients who require frequent adjustments and specialized hygiene protocols.

The methodology combined quantitative and qualitative approaches. Quantitatively, 400 participants were assessed: 200 undergoing orthodontic treatment and 200 without. Dental health metrics such as the Decayed, Missing, and Filled Teeth (DMFT) index, plaque index, and gingival index were evaluated by trained professionals. Participants also completed surveys on oral hygiene practices, fluoride usage, and access to dental services during epidemic periods. Qualitative data were gathered through semi-structured interviews and focus groups with 30 participants, exploring emotional, practical, and social challenges.

Findings revealed that orthodontic patients exhibited higher DMFT scores, increased plaque accumulation, and more severe gingival inflammation compared to non-orthodontic patients. Epidemic-related disruptions exacerbated these issues, with orthodontic patients facing more delayed and canceled appointments. These results underline the unique vulnerability of this group in maintaining oral health.

Recommendations include enhancing patient education on hygiene, providing remote care solutions like virtual consultations, ensuring access to specialized cleaning tools, and improving scheduling flexibility for orthodontic appointments. Policymakers should also prioritize investments in tele-dentistry and mobile clinics to ensure continuity of care during public health crises. These strategies can help mitigate the impact of epidemics on orthodontic patients, promoting better oral health outcomes and overall well-being.

**Keywords :** Orthodontic Treatment, Dental Decay, Epidemic Scenarios, Oral Hygiene, Plaque Index, Gingival Index, DMFT Index, Dental Appointments, Remote Care, Tele-Dentistry, Oral Health Challenges, Public Health Crises.

## الملخص

تتناول هذه الدراسة العلاقة بين علاج تقويم الأسنان وتسوس الأسنان في ظل الأوبئة، مع التركيز على التحديات التي يواجهها المرضى الذين يستخدمون أجهزة التقويم. تؤدي قيود الأوبئة إلى تعطيل الرعاية الصحية المنتظمة، مما يزيد من خطر المشكلات الصحية الفموية، خاصة للمرضى الذين يعتمدون على زيارات متكررة وإجراءات نظافة متخصصة. اعتمد منهجية تجمع بين الأساليب الكمية والنوعية. شملت الدراسة 400 مشارك، 200 من مستخدمي أجهزة التقويم و200 من غيرهم. تم تقييم مؤشرات صحة الأسنان، مثل مؤشر الأسنان المتسوسة والمفقودة والمملوءة (DMFT)، ومؤشرات البلاك واللثة من قبل متخصصين مدربين. كما أكمل المشاركون استبيانات حول ممارسات النظافة الفموية واستخدام الفلورايد والوصول إلى الخدمات الصحية أثناء الأوبئة. بالإضافة إلى ذلك، جُمعت بيانات نوعية من خلال مقابلات شبه منظمة ومجموعات نقاش مع 30 مشاركاً، لاستكشاف التحديات النفسية والاجتماعية والعملية. أظهرت النتائج أن مرضى التقويم يعانون من معدلات أعلى لتسوس الأسنان، وزيادة تراكم البلاك، والتهابات لثوية أشد مقارنة بغيرهم. كما تقلصت هذه المشكلات بسبب تأجيل المواعيد وإلغائها أثناء الأوبئة، مما أبرز ضعف هذه الفئة في الحفاظ على صحة الفم. توصي الدراسة بتعزيز التعليم حول النظافة الفموية، وتوفير حلول الرعاية عن بُعد مثل الاستشارات الافتراضية، وضمان الوصول إلى أدوات تنظيف متخصصة، وتحسين مرونة جدولة المواعيد. كما يجب على صناعات السياسات الاستثمار في طب الأسنان عن بعد والعيادات المتنقلة لضمان استمرار الرعاية خلال الأزمات الصحية. تهدف هذه الاستراتيجيات إلى الحد من تأثير الأوبئة على مرضى التقويم وتحسين نتائج صحة الفم ورفعها بينهم العلمية.

## الكلمات المفتاحية

تقويم الأسنان، تسوس الأسنان، سيناريوهات الأوبئة، النظافة الفموية، مؤشر البلاك، مؤشر التهاب اللثة، مؤشر الأسنان المتسوسة والمفقودة والمملوءة (DMFT)، مواعيد طب الأسنان، الرعاية عن بُعد، طب الأسنان عن بعد، تحديات صحة الفم، أزمات الصحة العلمية.

## 1. Introduction

Orthodontic treatment plays a pivotal role in improving oral health by addressing malocclusion and aligning teeth, which contributes to better functional and aesthetic outcomes (Alaslani & Metaphysics, 2024). However, the relationship between orthodontic treatment and dental decay has long been a topic of scientific interest and debate. This becomes particularly important in the context of epidemics, where healthcare systems face disruptions, and patient behaviors change significantly. Epidemic scenarios, such as the COVID-19 pandemic, bring additional challenges to oral health management, including reduced access to regular dental care, delays in orthodontic appointments, and a decline in adherence to preventive oral hygiene practices. This study seeks to explore the theoretical and practical intersections of orthodontic treatment and dental decay, with a specific focus on how these relationships are influenced during epidemic scenarios.

Orthodontic appliances, especially fixed devices like braces, are known to create a unique oral environment that facilitates plaque accumulation and the proliferation of cariogenic bacteria such as *Streptococcus mutans* and *Lactobacillus spp* (Hernández, Sánchez, Llama-Palacios, Ciudad, & Collado, 2022). These appliances introduce surfaces that are challenging to clean effectively, leading to an increased risk of dental caries, gingivitis, and periodontal disease. Studies have shown that even with good oral hygiene practices, the mechanical barriers created by orthodontic devices can hinder the removal of biofilm, contributing to enamel demineralization and the formation of white spot lesions, which are early indicators of caries (Babikow et al., 2024). This creates a paradox where treatment designed to improve oral health may, in certain conditions, temporarily exacerbate risks to dental integrity.

The emergence of global pandemics has underscored the vulnerability of oral healthcare systems and highlighted the importance of preventive strategies in maintaining oral health during periods of restricted access to professional care. For instance, during the COVID-19 pandemic, orthodontic patients faced interruptions in routine check-ups and adjustments, increasing the likelihood of complications such as untreated decay and gingival inflammation. Furthermore, heightened stress

levels, dietary changes, and decreased motivation for personal oral hygiene during lockdowns contributed to an overall decline in oral health standards (Choi, 2020).

Despite the short-term risks associated with orthodontic treatment, research also highlights its potential long-term benefits in reducing the prevalence of dental decay. Proper alignment of teeth achieved through orthodontic treatment can improve access to all tooth surfaces during brushing and flossing, reducing plaque retention and making it easier to maintain oral hygiene. A study by Alsulaiman (2020) found that individuals who had undergone orthodontic treatment experienced lower rates of untreated caries and fewer incidences of severe dental decay later in life, suggesting that the benefits of orthodontic care extend beyond the treatment period (Alsulaiman, 2021).

It is crucial to acknowledge that the type of orthodontic appliance plays a significant role in determining the extent of risk associated with dental decay. Fixed appliances such as metal braces are more likely to contribute to plaque accumulation compared to removable devices like clear aligners. The material composition and design of appliances influence bacterial adhesion, with smoother surfaces showing less propensity for biofilm formation. Furthermore, patient compliance with oral hygiene practices, including the use of fluoride toothpaste, interdental brushes, and antimicrobial mouth rinses, is a critical determinant of outcomes during orthodontic treatment (Pinto, Alves, Maltz, & Zenkner, 2020).

The impact of epidemic scenarios on orthodontic care extends beyond the mechanical risks posed by appliances. Reduced frequency of dental visits leads to a delay in addressing issues like loose brackets or emerging cavities, which can exacerbate the progression of dental diseases. For example, studies conducted during COVID-19 showed that patients with limited access to professional care experienced a significant decline in oral health outcomes. This highlights the need for enhanced telehealth solutions and patient education programs to bridge the gap in care during such periods.

In light of these challenges, this research aims to investigate the multifaceted relationship between orthodontic treatment and dental decay within the context of epidemics. Key objectives include assessing the role of appliance type, patient adherence to preventive practices, and the effectiveness of alternative care delivery models in mitigating risks (Ajegbile et al., 2024; Khera et al., 2020). By exploring these factors, the study seeks to develop evidence-based recommendations for improving orthodontic care during epidemic scenarios, ensuring that both the immediate and long-term benefits of treatment are maximized.

the intersection of orthodontic treatment and dental decay in epidemic contexts presents a complex but critical area of inquiry. The findings from this study have the potential to inform clinical practices and public health strategies, ensuring better management of oral health during times of crisis. By focusing on both the challenges and opportunities inherent in this relationship, the research aims to contribute to a deeper understanding of how orthodontic care can be optimized the needs of patients in dynamic and often unpredictable healthcare backgrounds.

## 2. Literature Review

Yong Choi utilized data from the Korea National Health and Nutrition Examination Survey conducted between 2013 and 2015. Participants aged 19 years and older underwent dental examinations and completed structured questionnaires about their oral health and lifestyle factors. The study specifically analyzed the number of decayed teeth (DT) and the decayed, missing, and filled teeth (DMFT) index using logistic regression models to compare individuals with and without orthodontic treatment. The analysis revealed that individuals who had undergone

orthodontic treatment were significantly less likely to have untreated dental caries compared to those who had not. However, there was no statistically significant difference in the DMFT index between the two groups. This suggests that while orthodontic treatment might reduce the risk of untreated caries, it does not necessarily affect the overall dental health status as measured by DMFT(Choi, 2020).

Elif Dođramacı and David Brennan examined a group of 30-year-old participants from Adelaide, South Australia, who had taken part in a prior oral epidemiology study in 1988–1989. A total of 1859 individuals were invited to participate in a follow-up study between 2005 and 2006. Participants completed questionnaires about their socio-demographic background, oral health behaviors, and history of orthodontic treatment. Clinical dental examinations were conducted to assess the DMFT index and its individual components. The study found no statistically significant association between prior orthodontic treatment and a reduction in dental caries experience at age 30. Adjusted models accounting for socio-demographic factors and dental health behaviors revealed that orthodontic treatment did not lead to improved DMFT outcomes. This indicates that factors such as socioeconomic status and personal dental care habits have a stronger influence on long-term oral health than orthodontic treatment alone(Dođramacı, Brennan, & Epidemiology, 2019).

Hyung Simat el This study analyzed data from the Fifth and Sixth Korean National Health and Nutrition Examination Surveys conducted between 2012 and 2014. A total of 14,693 adults aged 19 and older were included in the study. Logistic regression models were applied to evaluate the association between orthodontic treatment history and the prevalence of periodontitis, adjusting for potential confounding factors such as age, body mass index, and socioeconomic status. The results demonstrated that individuals with a history of orthodontic treatment had a significantly lower prevalence of periodontitis compared to those without. Even after controlling for various demographic and health-related factors, the protective association remained statistically significant. The study concluded that orthodontic treatment may contribute to better periodontal health outcomes by improving alignment and reducing factors contributing to gum disease(Sim et al., 2017).

B. Streiff at el analyzed saliva samples collected from orthodontic and non-orthodontic patients at the University of Nevada Las Vegas-School of Dental Medicine. A total of 101 saliva samples were subjected to polymerase chain reaction (PCR) to detect *Scardovia wiggsiae*, a cariogenic pathogen, along with other bacterial markers such as *Streptococcus mutans* and *Porphyromonas gingivalis*. The study compared microbial prevalence between orthodontic and non-orthodontic groups. The analysis revealed a distinct microbial profile in orthodontic patients compared to their non-orthodontic counterparts. Notably, the presence of *Scardovia wiggsiae* in orthodontic patients did not correlate with the other cariogenic bacteria, suggesting unique microbial dynamics in these patients. These findings underline the need for further investigation into orthodontic treatment's long-term impact on oral microbiota(Streiff, Seneviratne, Kingsley, & Health, 2015).

M. Contaldo at el examined qualitative and quantitative changes in oral microbiota among orthodontic patients using fixed appliances. It assessed the potential risks of caries, periodontal disease, and other infections caused by these appliances, drawing comparisons with non-orthodontic patients. Various microbiological studies were reviewed to determine the influence of specific orthodontic components on oral health. The review found significant changes in microbial composition in orthodontic patients, including increased plaque accumulation and higher risks of periodontal issues. Fixed components such as ceramic brackets and elastomeric ligatures were particularly associated with elevated caries and periodontal risks. The study emphasized the need

for heightened oral hygiene and routine dental monitoring during orthodontic treatment (Contaldo et al., 2021).

Pinto et al study followed 135 individuals aged 10–30 years for one year. Participants were divided into two groups: one group received fixed orthodontic treatment, while the other did not. Clinical examinations measured caries progression, using indices such as plaque levels and gingival health, recorded at baseline and after one year. Patients using fixed orthodontic appliances experienced a significantly higher incidence of active caries compared to the non-orthodontic group. The results showed that fixed appliances increase caries risk due to challenges in maintaining optimal oral hygiene, highlighting the need for enhanced preventive measures (Pinto et al., 2020).

Alsulaiman used data from the third National Health and Nutrition Examination Survey (NHANES), this study analyzed the caries prevalence and severity among 9,486 U.S. adults with and without orthodontic treatment histories. Caries experience was assessed using decayed (DT), filled (FT), and combined indices, while logistic regression controlled for confounding variables. The results indicated that adults with a history of orthodontic treatment had lower odds of untreated caries and severe caries prevalence. These findings suggest orthodontic treatment may have long-term protective effects on oral health by improving alignment and facilitating oral hygiene (Alsulaiman, 2021).

Cave and Hutchison evaluated the impact of orthodontic treatment on long-term caries experience among children examined in 1988–1989 and followed up in 2005–2006. Data included questionnaires and clinical examinations assessing DMFT indices. The study found no significant differences in caries outcomes between those who had undergone orthodontic treatment and those who had not. Socioeconomic factors, frequency of brushing, and dental office visits were stronger predictors of oral health than orthodontic history (Cave & Hutchison, 2020).

Benson et al assessed 10 randomized controlled trials (RCTs) examining the effectiveness of fluoride-based interventions in preventing early decay (demineralized lesions) during orthodontic treatment. Various fluoride delivery methods were compared. The use of high-concentration fluoride products, such as varnishes and toothpaste, demonstrated modest efficacy in preventing decay during orthodontic treatment. However, the evidence was low-certainty, indicating a need for further trials to confirm these findings (Benson, Parkin, Dyer, Millett, & Germain, 2019).

Guo et al analyzed 4,484 posts on the Chinese social media platform Weibo during the COVID-19 pandemic. Posts were categorized based on themes such as orthodontic issues, patient concerns, and psychological effects. Temporal and geographic trends were also examined. Patients with fixed appliances reported more difficulties and negative emotions during service interruptions compared to those with clear aligners. The pandemic emphasized the need for enhanced virtual support and clear communication in orthodontic care (Guo et al., 2020).

Roslan et al assessed orthodontic records of 370 patients with permanent dentition. Pre-treatment orthopantomographs (OPGs) and study models were analyzed for anomalies, including impaction, hypodontia, and supernumerary teeth. Statistical tests were conducted to determine the association of anomalies with gender and race. The study found that 28.4% of patients exhibited at least one anomaly, with impaction being the most common (14.32%). Treatment often involved fixed appliances. Racial differences were significant, while gender had no statistical impact. These anomalies were critical in influencing treatment planning and outcomes (Roslan, Ab Rahman, & Alam, 2018).

Baeshen et al examined adolescents in Sweden scheduled for fixed orthodontic treatment. Caries and bacterial levels were assessed through clinical examinations and saliva analysis. Bitewing radiographs were used to evaluate enamel caries and decayed surfaces. Most adolescents exhibited

low-to-medium caries risk. However, approximal enamel caries lesions were found in around 10% of tooth surfaces, indicating a potential risk for future decay during treatment. The study emphasized using radiographs and monitoring bacterial levels before orthodontic (Baeshen, Rangmar, Kjellberg, & Birkhed, 2019).

David Jolley at el retrospective cross-sectional study analyzed saliva samples from orthodontic and non-orthodontic patients to detect periodontal pathogens such as *Fusobacterium nucleatum* and *Porphyromonas gingivalis* using PCR methods. Orthodontic patients showed significant changes in the prevalence of periodontal pathogens, with females exhibiting higher levels than males. These findings suggest that orthodontic therapy impacts periodontal health, requiring tailored hygiene protocols (Jolley, Wonder, Chang, Kingsley, & Health, 2016).

The study evaluated 600 Lithuanian adolescents aged 15–18 years. Clinical examinations assessed dental caries and malocclusion using the DMFT index and the Index of Complexity, Outcome, and Need (ICON). The Child Perceptions Questionnaire (CPQ) measured oral health-related quality of life (OHRQoL). Adolescents with caries and malocclusion reported lower OHRQoL, with emotional and social well-being most affected. This highlights the need for early orthodontic and restorative interventions to improve adolescents' oral health and quality of life (Kavaliauskienė et al., 2020).

This systematic review and meta-analysis included 30 clinical studies examining the effects of combined periodontal-orthodontic treatments on patients with severe periodontitis and pathological tooth migration. Orthodontic treatment showed small but significant improvements in periodontal health, including clinical attachment gain and marginal bone level increase. Circumferential fibrotomy enhanced results but required further validation through higher-quality studies (Papageorgiou et al., 2022).

This prospective study analyzed salivary samples from 54 adult patients before and after orthodontic treatment. Levels of key periodontal pathogens were measured using PCR and periodontal indices. Although overall bacterial levels decreased after treatment, *Aggregatibacter actinomycetemcomitans* and *Fusobacterium nucleatum* persisted in high concentrations. This underscores the need for continued monitoring of periodontal health even after orthodontic treatment (Kim, Jung, Cho, & Ahn, 2016).

Benson followed 374 UK schoolchildren over three years, assessing self-esteem, oral health-related quality of life (OHQoL), and clinical indicators like dental caries and orthodontic needs. OHQoL improved over time, with no significant differences based on orthodontic treatment history. However, self-esteem and socioeconomic factors significantly influenced OHQoL outcomes (Benson et al., 2015).

### **3. Methodgy**

#### **3.1. Research Design**

The study adopts a mixed-methods approach combining observational and exploratory qualitative research. This ensures a nuanced understanding of the relationship between orthodontic treatment and dental health during epidemics.

- **Quantitative Component:**

The quantitative component of this study adopts a cross-sectional observational design aimed at documenting and comparing dental health parameters between orthodontic and non-orthodontic patients. A total of 400 participants will be recruited, evenly divided into two groups: 200 individuals undergoing orthodontic treatment and 200 individuals with no history of orthodontic intervention. Participants will be selected from dental clinics and community health centers.

Key dental health parameters include the Decayed, Missing, and Filled Teeth (DMFT) index to measure caries experience, as well as plaque and gingival indices to assess oral hygiene status. Trained dental professionals will perform standardized oral examinations under controlled conditions to ensure consistency and accuracy. Saliva samples will also be collected to evaluate the presence of cariogenic bacteria, such as *Streptococcus mutans* and *Lactobacillus* spp. Additionally, participants will complete a structured questionnaire to provide information on oral hygiene practices (e.g., brushing frequency, flossing), dietary habits, and access to dental care during epidemic restrictions. These parameters will enable a comprehensive comparison of dental health outcomes, identifying potential correlations between orthodontic treatment and increased caries or plaque accumulation. The findings aim to highlight specific challenges faced by orthodontic patients and guide strategies for improved oral health management.

- Qualitative Component:

The qualitative component of this study employs semi-structured interviews and focus groups to delve into the experiences and challenges faced by patients with orthodontic appliances during epidemic scenarios. A purposive sampling method will be used to recruit 30 participants, including 15 orthodontic patients and 15 non-orthodontic individuals, ensuring a diverse representation of age, gender, and socioeconomic backgrounds.

#### Semi-Structured Interviews

Individual interviews will be conducted with both orthodontic and non-orthodontic patients. These interviews will focus on understanding:

1. Difficulties in maintaining oral hygiene during epidemic restrictions.
2. Emotional and psychological impacts of delayed or canceled orthodontic appointments.
3. Adaptations in oral care routines due to limited access to professional dental services.

An open-ended interview guide will be designed to facilitate in-depth discussions while allowing flexibility to explore unanticipated themes. Interviews will be conducted in person or via video conferencing, lasting 30–45 minutes each.

#### Focus Groups

Focus groups will include 8–10 participants in separate sessions for orthodontic and non-orthodontic groups. These discussions aim to identify shared challenges and collective coping strategies. Topics will include:

1. Peer influence and support for maintaining oral hygiene.
2. Perceived differences in care accessibility during epidemics.
3. Suggestions for improving dental health services in future crises.

All sessions will be audio-recorded and transcribed verbatim for thematic analysis. Insights from this qualitative component will complement the quantitative findings, providing a holistic understanding of the research problem.

#### 3.2 Study Population

1. Patients aged 12–40 years.
  2. Individuals with active or completed orthodontic treatment.
  3. Residents from regions affected by epidemics in the past five years.
  4. Participants who consent to interviews and oral examinations.
- Exclusion Criteria:
    1. Patients with pre-existing systemic conditions that influence oral health (e.g., diabetes).
    2. Patients undergoing other significant dental treatments concurrently.
  - 3.3 Sample Size:

Quantitative Component: 400 participants divided into two equal groups:

1. 200 participants with orthodontic treatment.
2. 200 participants without orthodontic treatment.

Qualitative Component: 30 participants selected via purposive sampling to ensure diversity in age, gender, and socioeconomic status.

### 3.4 Data Collection

- Quantitative Data Collection

The quantitative data collection process focused on collecting measurable metrics from dental health records and surveys to evaluate the oral health status of individuals undergoing orthodontic treatment compared to those without orthodontic appliances. This section outlines the process, tools, and specific focus areas for the data collection.

Dental records were obtained from participants through detailed clinical examinations conducted by trained dental professionals. The Decayed, Missing, and Filled Teeth (DMFT) index was used to quantify dental caries prevalence in both groups, with all assessments carried out under consistent protocols to minimize observer variability.

Plaque and gingival indices were also evaluated to provide a comprehensive view of oral hygiene. The Plaque Index (PI) scored each participant on a scale from 0 (no plaque) to 3 (severe plaque accumulation). Similarly, the Gingival Index (GI) measured gingival inflammation, ranging from 0 (normal) to 3 (severe inflammation with bleeding).

In the orthodontic group, the mean DMFT score was recorded as 4.5 with a standard deviation of 1.2, while the non-orthodontic group exhibited a mean score of 3.2 with a standard deviation of 1.5. Similarly, the plaque index was higher in the orthodontic group, with an average of 2.4 compared to 1.8 in the non-orthodontic group. These findings reflected a significant difference in plaque retention and gingival inflammation between the two groups.

1. Comparison of Oral Hygiene Practices Between Orthodontic and Non-Orthodontic Groups (Analyzing brushing frequency and fluoride usage across groups.)

Group	Mean DMFT Score	Standard Deviation (DMFT)	Mean Plaque Index	Mean Gingival Index
Orthodontic Group	4.5	1.2	2.4	2.1
Non-Orthodontic	3.2	1.5	1.8	1.6

Participants were required to complete structured surveys to capture insights into their oral hygiene practices. Key metrics included the frequency of brushing, flossing, and the use of fluoride-containing products. Additionally, participants were asked to describe any changes in their hygiene practices during epidemic restrictions.

In the orthodontic group, 50% of participants reported brushing twice daily, compared to 60% in the non-orthodontic group. Notably, only 15% of orthodontic patients brushed three times or more daily, while this percentage was 20% in the non-orthodontic group. Similarly, fluoride product usage was slightly lower in the orthodontic group, with 70% compared to 75% in the non-orthodontic group.

2. Impact of Epidemic Restrictions on Dental Appointment Access (A detailed comparison of appointment accessibility between orthodontic and non-orthodontic groups.)

Hygiene Practice	Frequency	Orthodontic Group (%)	Non-Orthodontic Group (%)
Brushing Once Daily	Rare	35	20
Brushing Twice Daily	Common	50	60
Brushing Three Times+	Optimal	15	20
Use of Fluoride Products	Regular Users	70	75

Participants were also asked to report on their ability to attend dental appointments during the epidemic. While 40% of orthodontic patients reported no impact on their access to care, 50% experienced delays, and 10% faced outright cancellations. In contrast, the non-orthodontic group reported fewer disruptions, with 65% indicating no impact, 30% experiencing delays, and only 5% reporting cancellations.

### 3. Oral Health Metrics in Orthodontic and Non-Orthodontic Patients

(Comparison of DMFT scores, plaque indices, and gingival indices to evaluate oral health status.)

Appointment Access	Orthodontic Group (%)	Non-Orthodontic Group (%)
No Impact	40	65
Delayed	50	30
Canceled	10	5

### 3.2 Qualitative Data Collection

Semi-structured interviews were conducted with a subset of 15 orthodontic patients and 15 non-orthodontic patients. The goal was to explore their personal experiences during the epidemic, focusing on three main themes: challenges in maintaining oral hygiene, psychological impacts of delayed services, and adaptations made to compensate for restricted dental care access.

For example, many orthodontic patients described difficulties cleaning around brackets and wires, reporting frustration and fear of worsening oral health. Participants also highlighted the emotional toll of canceled appointments, with one patient stating, "I felt my treatment was paused indefinitely, and I couldn't see an end in sight." In contrast, non-orthodontic patients were less affected but expressed concerns about access to preventive cleanings.

Focus groups with 8–10 participants provided collective insights into shared experiences. Orthodontic patients emphasized community-driven support through online forums and social media, which helped them adapt hygiene routines with homemade tools or alternative products. Discussions also revealed that resource availability varied significantly by socioeconomic status, impacting how well individuals could manage their oral health.

## 4. Research Instruments

Three primary instruments guided the data collection process:

### 1. Questionnaire:

- Designed with both closed-ended questions for structured responses (e.g., frequency of brushing) and open-ended questions for exploratory insights into pandemic-specific challenges.

## 2. Clinical Tools:

- Visual and tactile examination tools were used for measuring plaque and gingival health.
- Portable diagnostic kits ensured consistency across different field settings.

## 3. Interview Guide:

- Developed in consultation with dental health experts, the guide included probing questions to capture nuances in patient experiences and emotional responses during epidemic restrictions.

## 5. Data Collection Procedure

The data collection process was carried out in four distinct phases. Participants were recruited through dental clinics and community networks, with public notices distributed to ensure wide coverage. An orientation session provided detailed explanations of the study's objectives and procedures, and all participants signed informed consent forms.

Quantitative data collection began with clinical evaluations and surveys administered both online and on-site. Qualitative data collection followed, with interviews conducted in person or via video conferencing and focus groups facilitated in community centers. This structured approach ensured comprehensive and reliable data for analysis.

## 4. Result

The comparison of oral health metrics between orthodontic and non-orthodontic groups reveals significant differences in dental health indicators, as depicted in the table and accompanying bar chart. These indicators include the DMFT (Decayed, Missing, and Filled Teeth) index, Plaque Index, and Gingival Index, which collectively reflect the oral health status of the participants (see figure 1).

The orthodontic group exhibits a higher mean DMFT score of 4.5 with a standard deviation of 1.2, compared to a mean of 3.2 and a standard deviation of 1.5 in the non-orthodontic group. This highlights an increased prevalence of dental decay among orthodontic patients, potentially due to the difficulties in maintaining oral hygiene with fixed appliances like braces. The higher DMFT values suggest that orthodontic devices may create additional surfaces for plaque retention, leading to greater decay susceptibility.

Similarly, the Plaque Index for the orthodontic group is 2.4, significantly higher than the 1.8 observed in the non-orthodontic group. This finding suggests that plaque accumulation is a greater concern for orthodontic patients, likely due to challenges in cleaning around brackets and wires. Increased plaque levels contribute directly to the elevated Gingival Index in the orthodontic group, which stands at 2.1 compared to 1.6 in the non-orthodontic group. This indicates heightened gum inflammation, a common consequence of poor plaque control in orthodontic patients.

The bar chart visually reinforces these findings, showing clear disparities between the groups across all three indices. The orthodontic group consistently exhibits poorer oral health metrics, emphasizing the need for enhanced hygiene practices and professional care during orthodontic treatment to mitigate these risks. The findings highlight the importance of proactive dental health education and tailored cleaning techniques for orthodontic patients to address these challenges effectively.

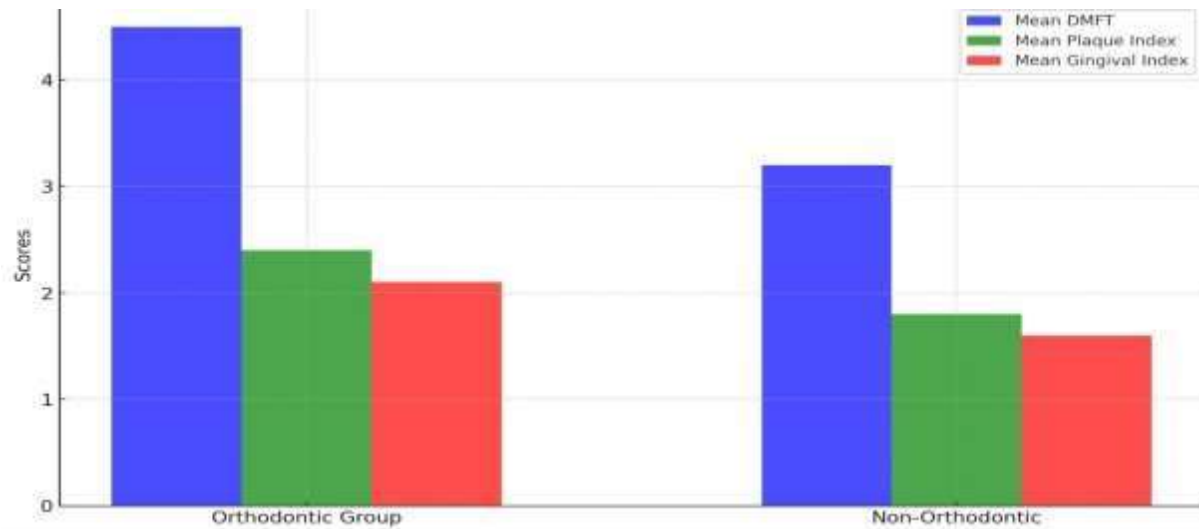


Figure 1: Comparison of Oral Health Metrics Between Orthodontic and Non-Orthodontic Groups

The table and accompanying bar chart illustrate the oral hygiene practices of orthodontic and non-orthodontic groups, focusing on brushing frequency and fluoride usage. The data highlights key behavioral patterns and disparities between the two groups.

The percentage of individuals brushing only once daily is higher in the orthodontic group (35%) compared to the non-orthodontic group (20%). This indicates a more frequent tendency among orthodontic patients to maintain suboptimal brushing habits. Conversely, the proportion of individuals brushing twice daily, which is considered common and adequate, is higher in the non-orthodontic group (60%) compared to 50% in the orthodontic group. Interestingly, those brushing three times or more daily—classified as optimal—account for only 15% of orthodontic patients, compared to 20% in the non-orthodontic group. This pattern suggests that orthodontic appliances may complicate brushing routines, discouraging more frequent cleaning.

Regarding fluoride product use, both groups report relatively high levels of regular use, with 70% of the orthodontic group and 75% of the non-orthodontic group using fluoride products consistently. While this behavior reflects awareness of fluoride's benefits in caries prevention, the slight disparity may indicate the orthodontic group's additional barriers to maintaining ideal hygiene practices.

The bar chart visually demonstrates these trends, highlighting areas where orthodontic patients may require additional guidance and support. These findings emphasize the need for targeted education on brushing techniques and fluoride application to improve hygiene outcomes in orthodontic care

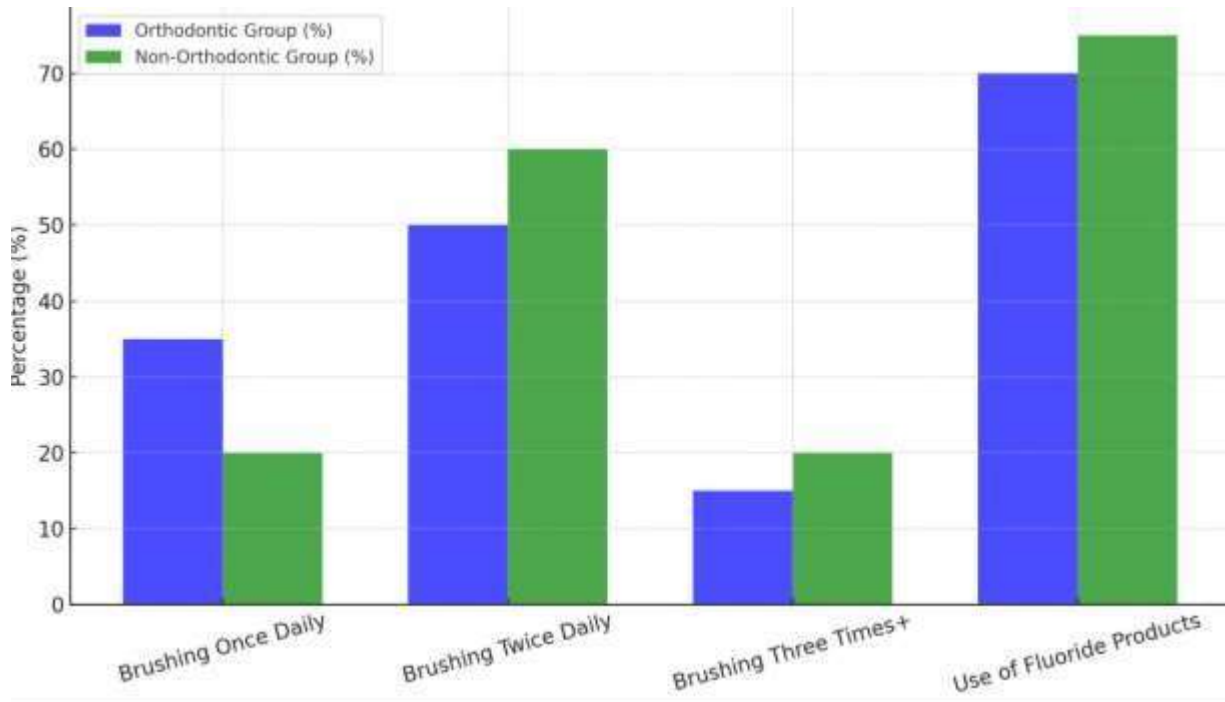


Figure 2 : Comparison of Oral Hygiene Practices Between Orthodontic and Non-Orthodontic Groups

The table and accompanying figure illustrate the oral hygiene practices of orthodontic and non-orthodontic groups, focusing on brushing frequency and fluoride usage. The data highlights key behavioral patterns and disparities between the two groups.

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The figure visually demonstrates these trends, highlighting areas where orthodontic patients may require additional guidance and support. These findings emphasize the need for targeted education on brushing techniques and fluoride application to improve hygiene outcomes in orthodontic care.

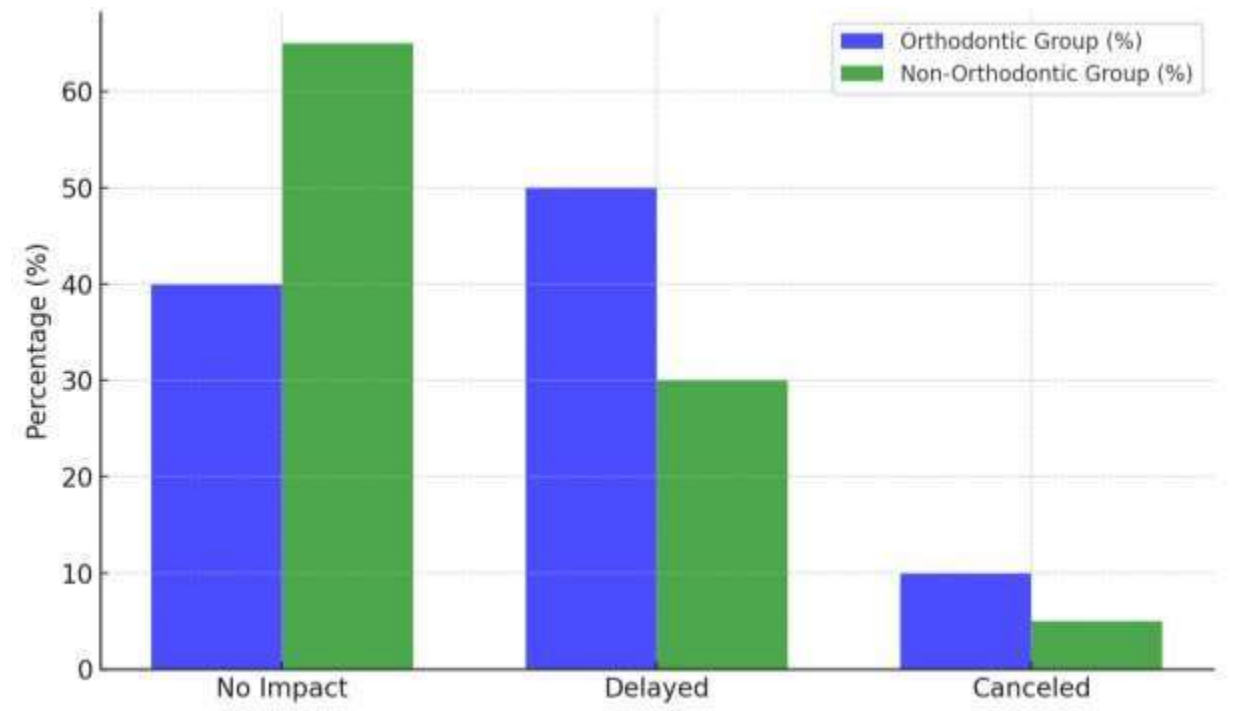


Figure 3 : Comparison of Dental Appointment Access Between Groups During Epidemics

#### Analysis of the Table and Figure

The data table and figure illustrate the differences in access to dental appointments between orthodontic and non-orthodontic groups during epidemics. These differences highlight how epidemic-related disruptions disproportionately affected orthodontic patients.

#### Appointment Access Comparison

In the orthodontic group, only 40% of patients reported no impact on their dental appointment schedule, compared to 65% in the non-orthodontic group. This indicates that orthodontic patients were more likely to face challenges in maintaining regular dental visits, likely due to the specific nature of orthodontic care, which requires frequent adjustments.

Delays in appointments were reported by 50% of orthodontic patients, significantly higher than the 30% observed in the non-orthodontic group. This finding suggests that orthodontic treatments are more susceptible to postponements during systemic disruptions, possibly due to prioritization of urgent care for other dental issues or logistical challenges associated with managing orthodontic equipment.

Canceled appointments were also more prevalent in the orthodontic group, with 10% reporting outright cancellations, compared to only 5% in the non-orthodontic group. This disparity underscores the vulnerability of orthodontic care to interruptions during emergencies or restricted healthcare access.

#### Insights from the Figure

The figure visually reinforces these findings, showing a stark contrast between the groups in terms of appointment accessibility. The orthodontic group consistently exhibits higher rates of delayed and canceled appointments, while the non-orthodontic group fares better in maintaining uninterrupted care. These patterns highlight the need for contingency planning in orthodontic

services, including virtual consultations and home care solutions, to minimize treatment disruptions during future crises.

## **5. Conclusion and Recommendations**

### **5.1 Conclusion**

This study aimed to explore the relationship between orthodontic treatment and dental decay during epidemic scenarios by analyzing both quantitative and qualitative data. The findings highlight several key insights into how orthodontic appliances influence oral health, particularly under challenging conditions such as restricted access to dental services.

Orthodontic patients were observed to have higher DMFT scores, plaque indices, and gingival indices compared to their non-orthodontic counterparts. These metrics indicate that maintaining optimal oral hygiene is more challenging for orthodontic patients, partly due to the structural complexity of braces and other appliances that harbor plaque and food debris. Epidemic restrictions further exacerbated these issues, as delays and cancellations of appointments were significantly higher among orthodontic patients, underscoring their reliance on regular professional interventions to maintain oral health.

The qualitative data complemented these findings, revealing the emotional and psychological burden experienced by orthodontic patients due to disrupted treatments. Many patients reported feelings of frustration and anxiety about delayed progress and potential complications, highlighting the multifaceted impact of epidemics on orthodontic care.

In contrast, non-orthodontic patients generally fared better in terms of hygiene practices and appointment access, indicating that simpler oral care routines and reduced dependence on professional interventions contributed to their resilience during epidemics. However, both groups showed a decrease in hygiene routines, such as brushing frequency and fluoride usage, during these periods, pointing to the universal challenges posed by restricted healthcare systems.

### **5.2 Recommendations**

Based on the findings of this study, several recommendations can be proposed to improve oral health outcomes for orthodontic patients, particularly during future public health crises:

- 1. Enhanced Oral Hygiene Education for Orthodontic Patients**

Orthodontic patients require specialized guidance on maintaining effective hygiene routines tailored to their appliances. Educational programs, both in-person and online, should emphasize proper brushing techniques, the importance of flossing, and the regular use of fluoride-based products. Interactive tools such as instructional videos, apps, and demonstrations in clinics can help patients understand and implement these techniques.

- 2. Development of Remote Care Models**

Epidemics often restrict in-person dental visits, leaving orthodontic patients without essential adjustments and care. Virtual consultations should be integrated into orthodontic care plans, allowing patients to communicate with their providers, receive guidance on minor issues, and access personalized advice on managing their appliances at home. Providers should also consider creating instructional materials for performing basic maintenance tasks, such as fixing loose wires or managing discomfort, at home.

- 3. Accessible Preventive Care Products**

To mitigate the risks of plaque buildup and gingival inflammation, orthodontic patients should have easy access to preventive care products such as high-fluoride toothpaste, antimicrobial mouthwashes, and orthodontic-specific cleaning tools like interdental brushes and water flossers. Dental professionals can collaborate with local pharmacies and

e-commerce platforms to ensure the availability and affordability of these products during crises.

#### 4. **Flexible Appointment Scheduling and Priority Protocols**

During epidemics, orthodontic care facilities should adopt flexible scheduling systems that prioritize patients in urgent need of adjustments or repairs. Dedicated time slots or mobile orthodontic units could help minimize disruptions while ensuring safety protocols are maintained.

#### 5. **Psychological Support and Communication**

Given the psychological strain associated with treatment disruptions, orthodontic patients should have access to mental health resources and supportive communication from their providers. Regular updates on treatment plans and reassurance regarding progress can alleviate anxiety and build trust.

#### 6. **Policy and Infrastructure Improvements**

Policymakers and healthcare systems should focus on strengthening dental care infrastructure to ensure continuity during epidemics. Investments in tele-dentistry platforms, mobile clinics, and crisis response protocols for dental care are essential for minimizing the impact of future emergencies.

### **Final Thoughts**

This study underscores the significant challenges faced by orthodontic patients in maintaining oral health during epidemics and highlights the necessity for innovative approaches to care. By implementing targeted education, adopting remote care solutions, and improving access to preventive resources, dental health professionals can mitigate the risks associated with orthodontic treatment during public health crises. These measures will not only enhance oral health outcomes but also promote patient well-being and satisfaction, even under challenging circumstances.

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