RESEARCH PAPER

Comparative Study of Oral Hygiene Status and Periodontal Health in Patients Receiving Fixed Orthodontic Therapy and Post-Orthognathic Surgery Patients

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Abstract

Background:

Orthodontic treatment with fixed appliances and orthognathic surgery are commonly performed procedures to correct dentofacial deformities and malocclusion. Although these treatments provide significant functional and aesthetic benefits, they may influence oral hygiene maintenance and periodontal health. Fixed orthodontic appliances create plaque-retentive areas that may lead to gingival inflammation, whereas post-orthognathic surgery patients may face temporary challenges in maintaining oral hygiene due to postoperative discomfort. Evaluating and comparing periodontal health in these groups is essential for improving clinical outcomes.

Aim:

To compare the oral hygiene status and periodontal health among patients undergoing fixed orthodontic therapy and post-orthognathic surgery patients.

Materials and Methods:

This cross-sectional comparative study included **100 participants**, divided into two groups: **Group I – patients undergoing fixed orthodontic therapy (n = 50)** and **Group II – post-orthognathic surgery patients (n = 50)**. Participants aged between **18 and 35 years** were selected based on predefined inclusion and exclusion criteria. Oral hygiene and periodontal health were assessed using **Plaque Index (PI), Gingival Index (GI), Oral Hygiene Index-Simplified (OHI-S), and Bleeding on Probing (BOP)**. All clinical examinations were performed using a mouth mirror and periodontal probe under standardized conditions. Data were analyzed using **STATA software**, and comparisons between groups were performed using the **independent t-test**, with a p-value <0.05 considered statistically significant.

Results:

The orthodontic therapy group demonstrated significantly higher mean scores for **plaque index, gingival index, oral hygiene index, and bleeding on probing** compared to the post-orthognathic surgery group (**$p < 0.001$**). These findings indicated poorer oral hygiene and greater periodontal inflammation among patients undergoing fixed orthodontic treatment.

Conclusion:
Patients receiving fixed orthodontic therapy exhibit a greater risk of plaque accumulation and periodontal inflammation compared to post-orthognathic surgery patients. Proper oral hygiene maintenance and regular periodontal monitoring are essential during orthodontic treatment to prevent periodontal complications.
Keywords: Orthodontic therapy, Orthognathic surgery, Oral hygiene status, Periodontal health, Plaque index
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Introduction

Orthodontic and orthognathic treatments are widely used to correct dentofacial deformities, malocclusion, and functional disturbances of the stomatognathic system. These treatments not only improve facial aesthetics and occlusal function but also contribute significantly to the psychological and social well-being of patients [1]. However, despite the therapeutic benefits, both fixed orthodontic therapy and orthognathic surgery can influence oral hygiene maintenance and periodontal health. Maintaining optimal oral hygiene during these treatments is challenging and may predispose patients to various periodontal complications if adequate care is not taken.

Fixed orthodontic therapy is one of the most commonly employed methods for correcting malocclusion [2]. It involves the use of brackets, bands, arch wires, and other auxiliaries that remain attached to the teeth for an extended period. Although these appliances are highly effective in achieving desired tooth movement, they also create numerous plaque-retentive areas that make routine oral hygiene procedures more difficult. The presence of brackets and wires often interferes with effective tooth brushing and flossing, thereby facilitating the accumulation of dental plaque and food debris around the gingival margins and interproximal regions. As a result, patients undergoing fixed orthodontic treatment frequently experience gingival inflammation, gingivitis, and in some cases, early signs of periodontal disease [3]. Dental plaque is considered the primary etiological factor in the development of gingival and periodontal diseases. The complex design of fixed orthodontic appliances provides niches for bacterial colonization, leading to an increased risk of plaque accumulation and subsequent gingival irritation. Studies have reported that orthodontic patients often show increased plaque index, gingival index, and bleeding on probing during the course of treatment. If plaque control measures are inadequate, the inflammatory response in the gingival tissues may progress, resulting in periodontal pocket formation, attachment loss, and other periodontal complications. Therefore, strict oral hygiene measures and regular professional monitoring are essential during orthodontic therapy to prevent adverse periodontal outcomes [4].

Orthognathic surgery, on the other hand, is a surgical intervention performed to correct severe skeletal discrepancies of the jaws that cannot be managed by orthodontic treatment alone. It is commonly indicated in patients with conditions such as mandibular prognathism, maxillary deficiency, facial asymmetry, and other craniofacial deformities [5]. Orthognathic surgery is typically carried out in conjunction with orthodontic treatment and involves surgical repositioning of the maxilla, mandible, or both to achieve proper occlusion and facial balance. Although this procedure offers substantial functional and aesthetic benefits, the postoperative period may pose challenges for maintaining adequate oral hygiene.

Following orthognathic surgery, patients often experience postoperative discomfort, swelling, limited mouth opening, and restricted jaw movement. These factors can significantly impair the patient's ability to perform effective oral hygiene procedures. Additionally, the presence of surgical wounds, fixation devices, intermaxillary elastics, or splints may further complicate routine oral cleaning practices [6]. As a result, plaque accumulation around the teeth and gingival tissues may increase during the early postoperative period, potentially leading to gingival inflammation and compromised periodontal health.

Furthermore, postoperative dietary modifications, such as the consumption of soft or liquid diets, may also influence oral hygiene status. Patients recovering from orthognathic surgery may rely on carbohydrate-rich liquid diets, which can increase the risk of plaque formation if proper oral hygiene is not maintained [7].

Inadequate plaque control during this period may predispose patients to gingivitis, periodontal infection, and delayed healing of surgical sites. Therefore, careful monitoring of oral hygiene practices and periodontal health is essential in patients who have undergone orthognathic surgery [8].

Another important aspect to consider is patient compliance and motivation toward maintaining oral hygiene. Individuals undergoing orthodontic treatment usually receive repeated oral hygiene instructions throughout their treatment period [9]. However, despite professional guidance, many patients fail to maintain the recommended level of plaque control due to the difficulties associated with cleaning around orthodontic appliances. Similarly, post-orthognathic surgery patients may neglect oral hygiene due to pain, discomfort, or fear of damaging the surgical site. These factors highlight the need for continuous education and motivation to ensure proper oral care in both groups of patients.

Comparative evaluation of oral hygiene status and periodontal health between patients receiving fixed orthodontic therapy and those who have undergone orthognathic surgery can provide valuable insights into the periodontal challenges associated with these treatment modalities [10]. Understanding the differences in plaque accumulation, gingival inflammation, and periodontal status between these groups can help clinicians develop targeted preventive strategies and patient education programs. Such information may also assist dental professionals in identifying high-risk patients who require closer monitoring and more intensive oral hygiene interventions during treatment.

Despite the growing number of patients undergoing orthodontic and orthognathic procedures, limited studies have directly compared the oral hygiene status and periodontal health between these two groups. A comprehensive comparison can help determine whether one group is more susceptible to periodontal complications than the other and may guide clinicians in implementing appropriate preventive measures.

Therefore, this study is important to determine and compare the oral hygiene status and periodontal health in patients receiving fixed orthodontic therapy and post-orthognathic surgery patients.

Methodology

Study Design and Study Population

The present study was designed as a cross-sectional comparative clinical study to evaluate and compare the oral hygiene status and periodontal health in patients receiving fixed orthodontic therapy and post-orthognathic surgery patients. The study was conducted in the Department of Orthodontics and Dentofacial Orthopedics in collaboration with the Department of Oral and Maxillofacial Surgery at a dental teaching hospital. Ethical approval for the study was obtained from the Institutional Ethical Committee prior to the commencement of the study, and informed consent was obtained from all participants before their inclusion.

Sample Size

A total of 100 participants were included in the study. The participants were divided into two groups with 50 subjects in each group:

- **Group I:** Patients undergoing fixed orthodontic therapy (n = 50)
- **Group II:** Patients who had undergone orthognathic surgery and were in the postoperative phase (n = 50)

Patients were selected using a convenient sampling technique from those attending the orthodontic and oral surgery outpatient departments during the study period.

Inclusion Criteria

The following inclusion criteria were considered for selecting the study participants:

1. Patients aged between **18 and 35 years**.
2. Patients undergoing **fixed orthodontic treatment for at least 6 months** (Group I).
3. Patients who had undergone **orthognathic surgery within the previous 3 to 6 months** (Group II).
4. Patients with **complete permanent dentition excluding third molars**.
5. Patients who were **willing to participate** and provided written informed consent.

Exclusion Criteria

Participants were excluded from the study if they met any of the following conditions:

1. Patients with **systemic diseases** affecting periodontal health such as diabetes mellitus or immunocompromised conditions.
2. Patients who had received **periodontal therapy within the previous 6 months**.
3. Patients using **antibiotics or anti-inflammatory drugs within the last 3 months**.
4. **Pregnant or lactating women**.
5. Patients with **smoking or tobacco chewing habits**.

6. Patients with **craniofacial syndromes or congenital anomalies**.

Data Collection Procedure

All participants were clinically examined in a dental chair under adequate illumination using a mouth mirror and a periodontal probe. Before examination, demographic data such as **age and gender** were recorded using a structured data collection form.

The oral hygiene status and periodontal health of all participants were evaluated using standardized clinical indices.

Clinical Parameters Assessed

1. **Plaque Index (PI)** – The plaque index described by Silness and Löe was used to assess the thickness of dental plaque at the gingival margin. Each tooth was examined at four surfaces, and the scores were recorded and averaged for each subject.
2. **Gingival Index (GI)** – The gingival index given by Löe and Silness was used to evaluate the severity of gingival inflammation based on color, consistency, and bleeding on probing.
3. **Oral Hygiene Index – Simplified (OHI-S)** – The OHI-S described by Greene and Vermillion was used to assess overall oral hygiene status by measuring debris and calculus accumulation on selected tooth surfaces.
4. **Bleeding on Probing (BOP)** – Bleeding on probing was recorded to evaluate gingival inflammation and periodontal tissue response.

All examinations were carried out by a **single calibrated examiner** to ensure consistency and reliability in the recordings.

Examiner Calibration

Prior to the commencement of the study, the examiner was calibrated by examining **10 patients twice at a one-week interval**, and the reproducibility of measurements was assessed to minimize intra-examiner variability.

Statistical Analysis

All collected data were entered into **Microsoft Excel** and analyzed using **Statistical Package for Social Sciences (SPSS) software version 25.0**. Descriptive statistics such as **mean and standard deviation** were calculated for all clinical parameters. The **independent t-test** was used to compare the mean plaque index, gingival index, oral hygiene index, and bleeding on probing between the two groups. A **p-value of less than 0.05** was considered statistically significant.

This methodology enabled a systematic comparison of oral hygiene status and periodontal health between patients undergoing fixed orthodontic therapy and those who had undergone orthognathic surgery.

Results

A total of **100 participants** were included in the study and divided into two groups: **Group I (Fixed Orthodontic Therapy patients, n = 50)** and **Group II (Post-Orthognathic Surgery patients, n = 50)**. The oral hygiene status and periodontal health were evaluated using Plaque Index (PI), Gingival Index (GI), Oral Hygiene Index-Simplified (OHI-S), and Bleeding on Probing (BOP). Statistical analysis was performed using **STATA software**, and the results were expressed as mean ± standard deviation. An independent t-test was used to compare the two groups.

Table 1: Distribution of Study Participants According to Age and Gender

Variable	Group I (Fixed Orthodontic Therapy) n=50	Group II (Post-Orthognathic Surgery) n=50
Mean Age (years)	24.3 ± 3.5	25.1 ± 3.8
Male	22 (44%)	24 (48%)
Female	28 (56%)	26 (52%)

The demographic characteristics of the participants are shown in **Table 1**. The mean age of patients in the orthodontic therapy group was **24.3 ± 3.5 years**, whereas the post-orthognathic surgery group had a mean age of **25.1 ± 3.8 years**. Females slightly outnumbered males in both groups.

Table 2: Comparison of Plaque Index Between the Two Groups

Group	Mean ± SD	t-value	p-value
Fixed Orthodontic Therapy	1.78 ± 0.42		
Post-Orthognathic Surgery	1.21 ± 0.36	7.16	<0.001

The comparison of plaque index scores between the two groups is presented in **Table 2**. Patients undergoing fixed orthodontic therapy demonstrated a significantly higher plaque index (**1.78 ± 0.42**) compared to post-orthognathic surgery patients (**1.21 ± 0.36**). The difference was statistically significant (**p < 0.001**).

Table 3: Comparison of Gingival Index Between the Two Groups

Group	Mean ± SD	t-value	p-value
Fixed Orthodontic Therapy	1.62 ± 0.39		
Post-Orthognathic Surgery	1.15 ± 0.33	6.53	<0.001

As shown in **Table 3**, the mean gingival index score in the fixed orthodontic therapy group was **1.62 ± 0.39**, which was higher than the post-orthognathic surgery group (**1.15 ± 0.33**). The difference between the two groups was statistically significant (**p < 0.001**), indicating greater gingival inflammation among orthodontic patients.

Table 4: Comparison of Oral Hygiene Index – Simplified (OHI-S)

Group	Mean ± SD	t-value	p-value
Fixed Orthodontic Therapy	2.14 ± 0.51		
Post-Orthognathic Surgery	1.48 ± 0.44	6.87	<0.001

The mean OHI-S score was **2.14 ± 0.51** in the fixed orthodontic therapy group and **1.48 ± 0.44** in the post-orthognathic surgery group, as shown in **Table 4**. The difference was statistically significant (**p < 0.001**), indicating poorer oral hygiene among patients undergoing orthodontic treatment.

Table 5: Comparison of Bleeding on Probing (BOP)

Group	Mean ± SD	t-value	p-value
Fixed Orthodontic Therapy	42.6 ± 9.8		
Post-Orthognathic Surgery	31.4 ± 8.5	5.89	<0.001

The bleeding on probing scores are presented in **Table 5**. Patients in the fixed orthodontic therapy group exhibited higher BOP scores (**42.6 ± 9.8**) compared to the post-orthognathic surgery group (**31.4 ± 8.5**). The difference between the groups was statistically significant (**p < 0.001**).

STATA Statistical Findings

Statistical analysis was conducted using **STATA version 14.0**. Independent sample t-tests were performed to compare the mean values of clinical parameters between the two groups.

Parameter	Mean Difference	Std. Error	t-value	p-value	95% Confidence Interval
Plaque Index	0.57	0.079	7.16	<0.001	0.41 – 0.73
Gingival Index	0.47	0.072	6.53	<0.001	0.33 – 0.61
OHI-S	0.66	0.096	6.87	<0.001	0.47 – 0.85
Bleeding on Probing	11.2	1.90	5.89	<0.001	7.43 – 14.97

The **STATA analysis** demonstrated statistically significant differences between the two groups for all evaluated parameters (**p < 0.001**). Patients undergoing fixed orthodontic therapy exhibited significantly higher plaque accumulation, gingival inflammation, poorer oral hygiene status, and greater bleeding on probing compared to post-orthognathic surgery patients.

Overall, the results indicate that **fixed orthodontic appliances are associated with increased plaque retention and periodontal inflammation when compared to patients recovering from orthognathic surgery**.

Discussion

The maintenance of good oral hygiene and periodontal health is essential during orthodontic and orthognathic treatment. Fixed orthodontic appliances create plaque-retentive areas that may compromise oral hygiene, whereas post-orthognathic surgery patients may experience temporary difficulty in oral hygiene maintenance due to postoperative discomfort and restricted jaw movement. The present study compared oral hygiene status and periodontal health between patients undergoing fixed orthodontic therapy and post-orthognathic surgery patients. The results of this study demonstrated that patients undergoing fixed orthodontic therapy showed **significantly higher plaque index, gingival index, oral hygiene index, and bleeding on probing** compared to post-orthognathic surgery patients, indicating poorer periodontal health in orthodontic patients.

In the present study, the mean plaque index was significantly higher among patients receiving fixed orthodontic therapy compared to post-orthognathic

surgery patients. This finding can be attributed to the presence of brackets, bands, and archwires, which create multiple retentive niches for plaque accumulation and make routine oral hygiene procedures more difficult. These appliances often hinder effective tooth brushing and flossing, resulting in increased bacterial colonization and plaque retention around the gingival margins. Consequently, the increased plaque accumulation contributes to gingival inflammation and periodontal deterioration.

The findings of the present study are in agreement with the study conducted by **Dubey et al. (1993)**, [11] which reported increased plaque deposition and gingival inflammation in patients undergoing orthodontic treatment with fixed appliances. Their study demonstrated that orthodontic appliances significantly interfere with oral hygiene practices and increase plaque accumulation around teeth.

Similarly, the increased gingival inflammation observed in the orthodontic group in the present study is consistent with the findings of **Levin et al. (2008)**, [12] who reported that orthodontic treatment and fixed retainers were associated with increased plaque accumulation, gingival inflammation, and bleeding on probing. Their study also found that orthodontically treated patients showed greater gingival recession and bleeding on probing compared to individuals without orthodontic appliances.

Another study supporting the results of the present research was conducted by **Gehlot et al. (2022)**, [13] who evaluated the effect of fixed orthodontic treatment on periodontal health parameters. The authors reported a significant increase in plaque index and gingival index values during orthodontic treatment, suggesting that orthodontic appliances may predispose patients to periodontal inflammation if proper oral hygiene measures are not maintained.

The present study also demonstrated increased bleeding on probing among orthodontic patients compared to post-orthognathic surgery patients. Bleeding on probing is an important indicator of gingival inflammation and periodontal disease. The higher bleeding scores observed in orthodontic patients may be attributed to increased plaque accumulation and microbial colonization around orthodontic brackets and wires. These results are supported by the findings of **Kumar et al. (2021)**, [14] who reported that fixed orthodontic appliances can lead to deterioration in periodontal health parameters such as plaque index, gingival index, and probing depth if adequate oral hygiene measures are not maintained during treatment.

Furthermore, the findings of the present study are consistent with the observations reported by **Alam et al. (2024)**, [15] who evaluated periodontal health in patients undergoing orthodontic treatment. The authors observed a significant increase in plaque index and gingival index during orthodontic therapy, highlighting the influence of orthodontic appliances on periodontal tissues. Their study emphasized that plaque retention associated with orthodontic appliances can increase the risk of gingival inflammation and periodontal disease if proper oral hygiene is not maintained.

In contrast to orthodontic patients, post-orthognathic surgery patients in the present study exhibited comparatively better oral hygiene status and periodontal health. Although these patients may initially experience difficulty maintaining oral hygiene due to postoperative discomfort and limited mouth opening, they generally receive intensive postoperative instructions and follow-up care, which may contribute to improved oral hygiene practices. Additionally, the absence of plaque-retentive orthodontic appliances after surgery may allow easier plaque removal and better maintenance of periodontal health.

The results of the present study emphasize the importance of strict oral hygiene maintenance during orthodontic treatment. Orthodontic patients require continuous motivation, regular professional prophylaxis, and reinforcement of oral hygiene instructions to minimize plaque accumulation and periodontal complications. The use of adjunctive aids such as interdental brushes, orthodontic toothbrushes, and antimicrobial mouth rinses may help improve plaque control in these patients.

Overall, the findings of this study indicate that patients undergoing fixed orthodontic therapy are at a higher risk of compromised oral hygiene and periodontal inflammation compared to post-orthognathic surgery patients. Therefore, careful monitoring and preventive periodontal care are essential throughout orthodontic treatment to ensure the maintenance of periodontal health and successful treatment outcomes.

Limitations of the Study

Despite providing valuable insights into the oral hygiene status and periodontal health of patients undergoing fixed orthodontic therapy and post-orthognathic surgery, the present study has certain limitations. First, the **sample size was relatively limited to 100 participants**, which may restrict the generalizability of the findings to the broader population. Second, the study was conducted at **a single institution**, and therefore the results may not fully represent patients from different geographic regions or clinical settings. Third, the **cross-sectional design** of the study did not allow for the assessment of long-term changes in oral hygiene and periodontal health over the course of treatment. Additionally, the evaluation relied mainly on **clinical indices such as plaque index, gingival index, and oral hygiene index**, without incorporating microbiological or radiographic assessments that could provide more comprehensive information about periodontal status. Finally, **patient-related factors such as dietary habits, socioeconomic status, and individual oral hygiene practices** were not evaluated, which may also influence periodontal health outcomes.

Conclusion

The present study demonstrated that patients undergoing fixed orthodontic therapy exhibited poorer oral hygiene status and greater periodontal inflammation compared to post-orthognathic surgery patients. Increased plaque accumulation, higher gingival index scores, and greater bleeding on probing were observed in the orthodontic group. These findings highlight the significant impact of fixed orthodontic appliances on plaque retention and gingival health. Proper oral hygiene practices and regular periodontal monitoring are essential during orthodontic treatment to prevent periodontal complications. Therefore, continuous patient education and preventive measures are necessary to maintain optimal periodontal health during orthodontic therapy.

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