

Relationship between Fixed Orthodontic Treatment and Oral Hygiene. Patients Self-Reported Attitudes and Habits



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Received: 4 December 2024; Accepted: 17 December 2024; Published: 30 December 2024

Abstract

1.Aim and objectives: The objective of this evaluation was to assess data regarding the frequency, guidelines, and products associated with oral hygiene (OH) in orthodontic patients. 2.Material and methods: This study was a analysis conducted among orthodontic patients. Thirty patients, comprising twenty-five in the fixed orthodontic appliance and five in the removable orthodontic cohort, satisfied the inclusion criteria. A paired t-test was performed on all tested variables to evaluate intra-group and inter-group differences at each observation. p value of < 0.05 was considered statistically significant. 3.Results: All of the patients in the control and study groups were comparable regarding age, gender and initial plaque and gingival indices values ($p > 0.05$). The eighth week plaque and gingival indices of the test group were also significantly lower than those of the control group ($p < 0.001$). 4.Conclusions: Our findings indicate that conventional verbal and written instructional treatments are more effectively complemented by hands-on assisted training programs, contingent upon the orthodontist's limitations. A longer educational intervention correlates with improved preservation of plaque and gingival indices.

Keywords: oral hygiene, biofilm, prevention, orthodontic patients

INTRODUCTION

Malocclusion is frequently regarded as detrimental to an individual's physical, social, and mental health, as well as their self-esteem [1-3]. Consequently, patients seek orthodontic treatment to improve their aesthetics, oral functionality, psychological health, and overall quality of life. The primary motivation for adult patients pursuing orthodontic treatment is aesthetic enhancement [4].

Reports indicate that 40–62.4% of the population requires orthodontic treatment [5]. The heightened awareness of the advantages of orthodontic treatment has led to a rise in individuals pursuing such treatment during the past two decades [5]. The increasing demand for orthodontic treatment, coupled with the government's restricted capacity to provide such services, has facilitated the establishment of private orthodontic practices in Romania [6].

Orthodontic patients may necessitate either detachable or fixed appliance therapy depending on the diagnosis and severity of their issue. The elements of fixed orthodontic appliances, like as brackets, may provide an aesthetically displeasing appearance, impose functional limitations, and cause discomfort and agony during treatment, thereby impacting patients' oral health-related quality of life [7]. Previous research has delineated the distinctions between removable and fixed orthodontic treatment devices in terms of aesthetics, cost, technical and dental health considerations, and patient experiences [8]. The pain and discomfort levels experienced by patients receiving removable and fixed dental appliance therapy differed among the groups [9]. Furthermore, certain studies indicated a greater prevalence of eating disturbances in patients undergoing treatment with conventional fixed braces compared to those receiving detachable appliance therapy [10].

Orthodontic appliances will likely adversely affect oral hygiene indices due to the configuration and placement of both detachable and fixed devices. Nonetheless, prior studies yielded incongruous findings on the effects of removable and fixed braces modalities on dental health-related quality of life [10]. The conflicting results may be linked to the limited sample size, necessitating studies with bigger samples. Moreover, it remains uncertain if patients undergoing detachable appliance therapy experience less oral health implications compared to those receiving fixed appliance orthodontic therapy [11].

Dental caries and periodontal disease, the most prevalent oral disorders, are classified as behavioural diseases due to the essential role of adopting healthy oral habits in their management [12]. Literature indicates that orthodontic appliances affect the maintenance of oral hygiene [13]. The uneven surfaces of brackets, bands, wires, ligatures, and other orthodontic appliances have been demonstrated to enhance plaque accumulation and impede the teeth's natural cleansing processes, including the movement of the cheek muscles and salivary flow [14]. It is essential to acknowledge the heightened plaque accumulation induced by orthodontic appliances, as microbial plaque is the principal etiological factor in tooth caries and periodontal disorders, notwithstanding the varying pathogenic mechanisms implicated [15]. The literature indicates a correlation between fixed orthodontic treatment and various adverse conditions, including white spot lesions (WSL) resulting from dental plaque, carious lesions exhibiting cavitation alongside the advancement of WSL, and periodontal issues such as gingivitis, bleeding, and alveolar bone loss [16]. Such difficulties may extend or even conclude the orthodontic treatment process. The inability to mitigate the detrimental consequences of inadequate oral hygiene during orthodontic treatment may pose a considerable public health issue. Consequently, individuals receiving orthodontic treatment must maintain excellent oral hygiene practices and be cognizant of potential complications that may arise during the process.

Reports indicate that issues arising from plaque accumulation during orthodontic treatment can be mitigated with the application of appropriate dental hygiene education, patient awareness, and motivation tactics [15]. It is essential to assess the patient's perspective, disposition, and degree of compliance during the treatment process when evaluating the management system and the efficacy of orthodontic therapy. Patients have varying degrees of understanding and viewpoints concerning oral hygiene practices and the accompanying treatment risks. These disparities may stem from cultural shifts, accessibility of oral health care, and varying demographics [17]. To formulate effective oral hygiene programs in orthodontic treatment, it is crucial to assess the oral hygiene practices and the perceptions of treatment risks and attitudes towards orthodontic care among the target demographic.

Aim and objectives

This study aims to assess patients' opinions and perspectives regarding the correlation between orthodontic treatment and oral hygiene, as well as their oral hygiene practices. The comparison of oral health effects between removable and fixed orthodontic treatments remains a problem and requires additional evidence to inform the selection of orthodontic component therapy in clinical practice. This study posited that restrictions in daily activities, dietary intake, and mouth discomfort varied between patients undergoing detachable versus fixed orthodontic treatment. The study's aims can be summarized as follows: to evaluate patients' understanding of oral hygiene practices and potential oral health issues related to orthodontic treatment, to examine patients' perceptions regarding oral hygiene and orthodontic treatment, and to identify the factors that affect patients' attitudes and behaviours regarding oral hygiene throughout fixed orthodontic treatment.

The first null hypothesis was that none of the oral hygiene education methods would affect oral hygiene.

MATERIAL AND METHODS

The study design conforms to the requirements of the Declaration of Helsinki as adopted by the 18th World Medical Assembly in 1964 and subsequently revised. All subjects were informed about the nature and purpose of the study, and each subject signed an Informed Consent. The study was carried out between October 2020 and October 2023.

The subjects of this study were patients with fixed orthodontic appliances, and each had a minimum of 20 permanent teeth present in the oral cavity. The study group comprised 30 orthodontic patients recruited consecutively over a period of 6 months. The participants were randomly allocated to a test group (n = 15) and a control group (n = 15).

Inclusion criteria:

- (1) physically healthy with no relevant allergies or systemic diseases;
- (2) more than 12 years;
- (3) capable of maintaining adequate oral hygiene;
- (4) optimal dental health without immediate necessity for any associated dental procedures.

Exclusion criteria:

- (1) skeletal anteroposterior discrepancies between the maxilla and mandible;
- (2) differences between centric relation and centric occlusion over 3 mm;
- (3) active periodontal disease.

The oral hygiene condition was evaluated for each patient by plaque and gingival indices. The plaque index technique established by Heintze et al. [18] was employed to document the plaque condition of these orthodontic patients. Initially, all buccal and lingual

surfaces of the bonded teeth were marked with a revealing agent (Figure 1-3). Three sites were documented on the buccal surface of each tooth and three on the oral surface. The existence or nonexistence of plaque at each location was documented.



Figure 1. Clinical image before staining



Figure 2. Application of the disclosing agent buccal view



Figure 3. Application of the disclosing agent lateral view

To determine the percentage of plaque presence, the quantity of sites impacted by plaque was multiplied by the weighting factor and subsequently divided by the total number of teeth present. Banded teeth and third molars in the full dentition were excluded from the count, as the latter were infrequently banded. The buccal and lingual surfaces were utilized to compute the buccal plaque index and the lingual plaque index, respectively. The average plaque index was calculated by summing the buccal and lingual plaque indices. The gingival index system was adapted from Löe's methodology: healthy gingiva was assigned a score of 0, redness a score of 1, redness with probing-induced bleeding a score of 2, and spontaneous bleeding a score of 3 [19].

Each tooth was partitioned into buccal and lingual surfaces, which were subsequently subdivided into mesial, central, and distal sections. The gingival index for each tooth was recorded for six segments. The average buccal gingival index was calculated by summing the gingival indices from all buccal sites and dividing by the total number of teeth. The lingual gingival index was computed in a same fashion as the buccal gingival index. The mean gingival index was the aggregate of the buccal and lingual gingival indices.

Oral hygiene instruction

Control group - the patients in the control group received standard printed educational material and were assisted with verbal information.

Test group - the patients in this study group received hands-on training.

The significance of removing dental plaque for oral health was underscored, and oral hygiene instructions were reiterated by the same author at each appointment. All patient groups utilized identical toothbrushes and toothpaste during the trial and were instructed to

clean their teeth a minimum of three times daily for three minutes each session. The patients' brushing habits were assessed at each consultation, and the orthodontic archwires were secured using stainless steel wires.

The questionnaire was used in order to evaluate the sociodemographic attributes, baseline oral hygiene behaviors including toothbrushing techniques, frequency, and the utilization of oral hygiene adjuncts such as interdental brushes, dental floss, and mouth rinses by the participants. Eight questions were made to evaluate the patient's dental hygiene practices, focusing on the usage of dental floss, the daily frequency of tooth brushing, and the application of mouth rinse. The inquiries encompassed both closed and open-ended formats.

Data analysis

A paired *t*-test was performed on all tested variables to evaluate intra-group and inter-group differences at each observation. *p* value of < 0.05 was considered statistically significant.

RESULTS

The mean age of participants was 15.93 ± 1.39 years, with females predominant (63.33%). All the subjects used toothbrushes and toothpaste to clean their teeth daily, regarding the daily use of adjuncts, 66.66% of the study population made use of mouthwashes, 40% used dental floss, 36.6% interdental brush, 26.6% used toothpick, while only 23.33% used oral irrigator.

All of the patients in the control and test groups were comparable regarding age, gender and initial plaque and gingival indices values ($p > 0.05$). The test group show significant intra-group deterioration regarding plaque and gingival indices at the initial examinations ($p < 0.001$). However, the eighth week plaque and gingival indices in the control group patients significantly lower when compared with the initial index values ($p < 0.001$). The eighth week plaque and gingival indices of the test group were also significantly lower than those of the control group ($p < 0.001$).

DISCUSSIONS

This study examined the plaque and gingival indices of individuals undergoing various instructional approaches at the eighth week of therapy. The plaque index values of the two groups were significantly influenced by varying instructional approaches ($p < 0.05$). Consequently, the initial null hypothesis was accepted.

This study examined the effectiveness and therapeutic impact of several educational interventions on oral hygiene motivation in patients receiving fixed orthodontic treatment. Fixed appliance treatment is associated with adverse consequences, including gingivitis, white spots, decalcification, and cavity formation, unless patients maintain proper oral hygiene [20].

The establishment of oral hygiene prior to the initiation of orthodontic treatment is advised as an effective measure to prevent the aforementioned issues. As maintaining dental hygiene becomes increasingly challenging after the deployment of therapeutic appliances, the educational intervention for oral hygiene practices and orthodontic treatment materials is prioritized at the onset of treatment [21]. The sole recognized and effective method for attaining optimal oral hygiene involves educating the patient before treatment and fostering rapport between the physician and patient throughout the prolonged treatment process [22].

Previous researches have examined the efficacy of various techniques in enhancing oral hygiene compliance among patients receiving fixed orthodontic treatment to mitigate adverse consequences. Orthodontists are concerned that patient compliance may diminish

during the 4-6 week intervals between appointments; therefore, patients received various reminder messages or applications (text, WhatsApp, WeChat) highlighting the significance of proper oral hygiene, and the efficacy of these reminders was examined. All research indicated that reminders in dentistry enhanced patients' out-clinical management, consistent appointment attendance, favourable behavioural modifications, and educational outcomes [23-25].

Despite the aforementioned oral hygiene incentives requiring less time for each patient, we implemented educational activities that are more broadly embraced by orthodontic patients and have evolved into a long-term practice. Patient education regarding oral hygiene practices was deemed effective by vocal, written, or visual instructional methods [10]. These strategies have demonstrated greater efficacy when employed in conjunction rather than in isolation. It is recognized that practical training, in conjunction with verbal and written teaching methods, enhances success rates in the preservation of plaque and gingival indices during orthodontic treatment [23].

The primary objective of this study was to examine the duration of educational sessions across three distinct modes of information delivery and to assess its correlation with favourable outcomes in plaque and gingival indices. The efficacy of standard, and hands-on educational methods was also examined. The research indicated that both study cohorts effectively maintained oral hygiene, with no significant difference in the preservation rates of plaque and gingival indices ($p > 0.05$). While both standard and hands-on training required substantial time from the orthodontist, the period of hands-on education was significantly less than that of standard-assisted instruction ($p < 0.001$). This may present the orthodontist with two alternatives: a time-intensive choice (standard) or a labor-intensive way (hands-on assisted), contingent upon their limitations. Conversely, the control group, which underwent regular educational intervention, did not maintain oral hygiene, at least until the eighth week of therapy.

Despite being time and labor-intensive, hands-on assisted teaching methods appear to be more effective in maintaining plaque and gingival indices ($p < 0.001$), hence mitigating potential treatment consequences. The dental hygiene instruction encompassed the nomenclature of therapeutic equipment, their upkeep, and the proficient utilization of oral hygiene instruments. Patients were required to fully recall and accurately implement this information following the educational intervention. Furthermore, they needed to surmount their formidable and detrimental impulses and implicit withdrawal from dental hygiene practices. The orthodontist's motivation to administer oral hygiene through educational intervention is crucial for patients to comprehend and adhere to oral hygiene practices. It is advisable to reiterate subjects pertaining to dental hygiene at subsequent appointments [26].

Plaque accumulation is commonly seen and challenging to remove in regions where space maintainers are positioned. Due to their direct interaction with oral microorganisms, space maintainers serve as optimal sites for biofilm production. The composition of space maintainers is conducive to microbe adherence and biofilm development [27]. Moreover, the bands affixed to the supporting teeth of permanent space maintainers and the retention clasps of removable space maintainers can facilitate plaque formation and periodontal disease [28]. Nonetheless, the resemblance in color between the tooth surface and dental plaque can render it difficult to identify dental plaque, especially on polished surfaces [29]. Consequently, rendering plaque visible through the use of plaque-disclosing tablets or liquids is deemed the most effective method for maintaining dental hygiene [30].

The primary weakness of the study was the Hawthorne effect, which stemmed from the inability to blind participants. The elimination was unfeasible due to the agreement form acquired from patients and their guardians for study participation. The second limitation was the restricted follow-up time of eight weeks, with no long-term follow-up conducted. This

deficiency may be deemed typical since our study prioritizes training periods over the efficacy of oral hygiene motivation.

CONCLUSIONS

Our findings indicate that conventional verbal and written instructional treatments are more effectively complemented by hands-on assisted training programs, contingent upon the orthodontist's limitations. A longer educational intervention correlates with improved preservation of plaque and gingival indices. Orthodontists could potentially enhance patient safety by extending educational opportunities, such as showing video recordings in the waiting area or facilitating hands-on training in proper orthodontic oral hygiene and fixed appliance care, supervised by a dental hygienist. Oral hygiene education repeated at frequent intervals will be more effective for controlling dental plaque in patients with orthodontic treatment.

Conflicts of Interest

The authors declare no conflict of interest.

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