Oral health-related knowledge, attitudes, and behaviors of students wearing fixed orthodontic appliances at Hue University of Medicine and Pharmacy

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Abstract

Background: Oral hygiene is vital to each person's oral health, especially in those undergoing orthodontic treatment. However, only some people know how to properly and effectively clean their teeth. Therefore, assessing oral hygiene knowledge, attitudes, and behaviors is necessary. **Objectives:** To determine the level of knowledge, attitudes, and behaviors of oral hygiene of students wearing fixed orthodontic appliances and to examine the relationship between knowledge, attitude, behavior of oral hygiene, and plaque status in students who are wearing fixed orthodontic appliances. **Subjects and methods**: A cross-sectional study was carried out on 80 Hue University of Medicine and Pharmacy students wearing fixed orthodontic appliances. The study was conducted from 06/2023 to 09/2023. **Results:** 82.35% of students have adequate oral hygiene knowledge, 68.63% have a positive attitude, and 63.73% have proper behavior. The average plaque index on teeth is 0.988 ± 0.412, and our study found only a moderate positive association between plaque status and oral hygiene knowledge (r=0.307, p=0.005). **Conclusion**: Knowledge, attitude, and oral hygiene behavior are important factors that directly affect the effectiveness of the orthodontic process. Therefore, it is necessary to promote the provision of adequate oral hygiene knowledge, positive attitudes, and proper behaviors to improve the oral health of healthcare students - who have an impact on their health community in the future.

Keywords*: knowledge, attitude, behavior, oral hygiene, plaque, fixed orthodontic.*

1. INTRODUCTION

Oral health is essential to an individual's overall health and is related to knowledge and healthy oral hygiene habits. The World Health Organization defines oral health as one of the ten major health standards. Therefore, the care and prevention of oral diseases are significant concerns of the governments of many countries [1].

There are many ways to achieve good oral hygiene; many techniques have been shown to have a good impact on oral hygiene. One of the primary behaviors is brushing teeth [2]. Brushing your tongue, using mouthwash, brushing, and flossing will also help promote oral hygiene [3]. However, even with knowledge, without proper attitudes and practices, oral hygiene practices may not meet the requirements. Therefore, dental care is indispensable in human health care, especially in people undergoing orthodontic treatment with fixed appliances. Because the attachment of fixed appliances to the teeth will form a large amount of plaque around the brackets, along the gingival margin beneath the archwire, due to difficulties in oral hygiene, especially in the areas between the brackets and the gum line. Orthodontic appliances contribute to environmental changes, accumulating many acid-producing bacteria in dental plaque [4]. In addition, medical students are the object of better access and awareness about oral health care issues - trained to become doctors with a heart and a vision, cultivating knowledge, good oral health attitudes and behaviors, and preventing oral diseases play an essential role.

According to a study by Nada J Farsi (2020), knowledge of periodontal health in orthodontic patients related to dental plaque still needs improvement; only 8% correctly answered knowledge-related questions [5]. At Hanoi Medical University (2021), 12.8% of Odonto-Stomatology students had inadequate knowledge, and 11.2% had improper behavior in oral hygiene [6]. Studies on oral hygiene knowledge in students wearing fixed orthodontics still need to be conducted more. Therefore, we carried out the topic: "Oral health-related knowledge, attitudes, and behaviors of students wearing fixed orthodontic appliances at Hue University of Medicine and Pharmacy"

Objectives of the study:

- To assess the level of knowledge, attitude, and

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behavior of oral hygiene of students wearing fixed orthodontic appliances.

- To examine the relationship between knowledge, attitude, oral hygiene behavior, and plaque status in students wearing fixed orthodontic appliances.

2. MATERIALS AND METHODS

2.1. Study subjects

All students at Hue University of Medicine and Pharmacy (Hue UMP) who currently wearing fixed orthodontic appliances were invited to study. The self-administered questionnaire was completed by students. Data collection was undertaken from June 2023 to September 2023.

2.2. Study Methods

Study design

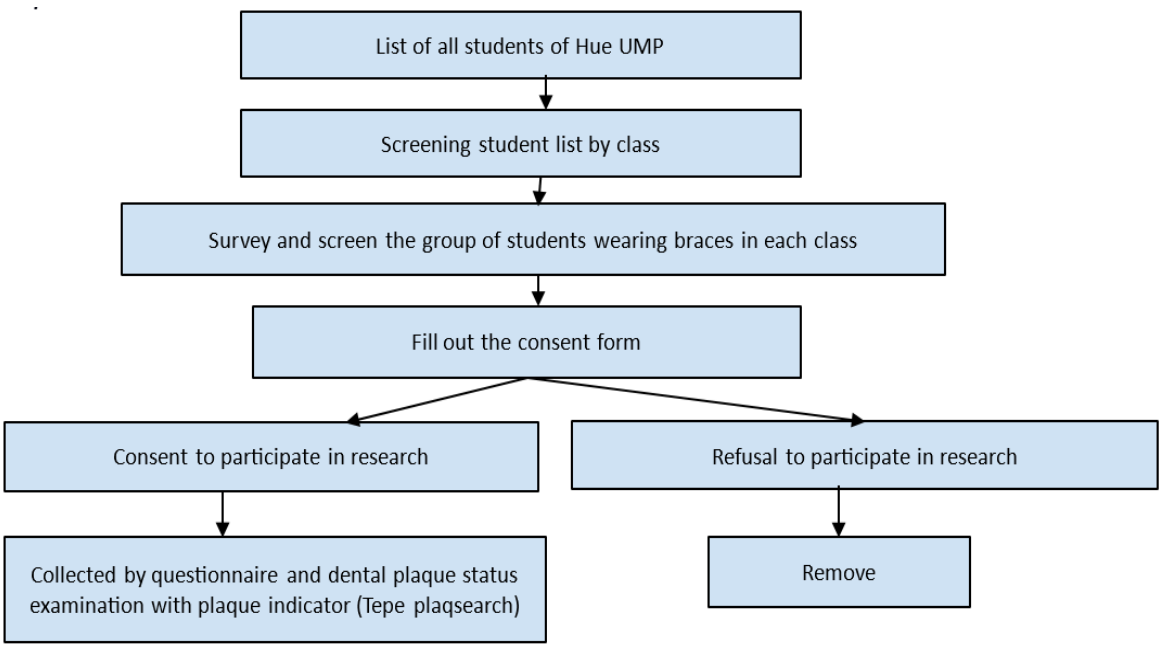
A cross-sectional descriptive study.

Sample size and sampling method

The study was conducted on 80 Hue UMP students undergoing orthodontic treatment with fixed appliances for both jaws.

Sampling method: Non-Probability Sampling Method (Convenience Sampling).

Steps taken



Research variables and assessment:

We recruited students and provided specific instructions for answering questions about knowledge, attitudes, and oral hygiene behaviors. The questionnaire consisted of 40 questions related to oral hygiene, divided into three parts [9]:

+ The "Knowledge" section included 13 questions focusing on dental plaque, tartar, dental caries, periodontal diseases, and the benefits of tooth brushing and oral hygiene practices.

+ The "Attitude" section consisted of 10 questions aimed at assessing awareness of the impact of braces on oral health and the importance of regular dental visits.

+ The "Behavior" section included 17 questions regarding oral hygiene activities, such as the duration and technique of tooth brushing, the type of toothbrush used, the frequency of toothbrush replacement, additional oral hygiene practices, dental check-ups, and eating habits that may affect oral health.

Each correct answer was counted as 1 point; a wrong answer did not deduct points. The total score of the questionnaire was 40 points. The survey results were categorized into two levels for knowledge, attitude, and behavior, respectively, as follows:

+ If ≥ 80% of the questions in a section were answered correctly, the assessment was considered adequate/positive/proper.

+ If < 80% of the questions in a section were answered correctly, the assessment was considered inadequate/negative/improper.

Plaque Index:

Definition of Variable: The Plaque Index was a quantitative variable, representing the total score across all evaluated sites. The examination and recording of plaque characteristics were based on

the Plaque Index score according to the assessment method by Silness and Löe, modified by Williams et al. for individuals with orthodontic braces. The Plaque Index scored plaque accumulation on teeth from 0 to 3 (Table 1) and assessed the buccal surfaces of all teeth with braces (excluding teeth with bands). Each tooth surface was divided into four regions: mesial, distal, gingival, and occlusal.

Table 1. Plaque Index (PI) by Löe and Silness (1967)

SCORE	PLAQUE INDEX (PI) ASSESSMENT CRITERIA
0	INDICATING NO PLAQUE
1	SHOWING PLAQUE ADHERING TO THE GINGIVAL MARGIN
2	INDICATING MODERATE SOFT DEPOSIT BUILDUP
3	SHOWING ABUNDANT SOFT MATTER

The average score of the four regions represented the gingival index for a tooth, and the average score of all teeth with braces was the score that represented the individual.

Plaque Characteristics

- Definition of Variable: Plaque characteristics were a nominal, non-ordinal variable.

- Method of Recording: Plaque characteristics (immature, mature) were recorded using a plaque dye, following the manufacturer's instructions.

+ Chewed a plaque-disclosing tablet.

+ Asked the patient to rinse gently with water and read the results immediately.

+ Recorded the plaque characteristics based on color indicators:

• Pink/red plaque color: immature plaque (<24 hours)

• Dark blue/purple color: mature plaque (>48 hours)

The average plaque index value based on the plaque characteristic was calculated by dividing the total number of plaque scores for each characteristic by the total number of tooth surfaces examined.

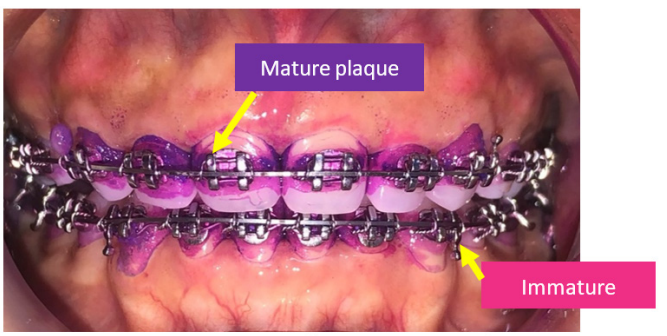


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Figure 1. Plaque after stained with a Plaq-Search chewing tablet

Data collection and analysis

Data were collected and cleaned using Excel and Epi Data 3.1 software. Results were presented using tables and percentage charts. Stata 14 software was used to process and analyze the data. Categorical variables were analyzed using the chi-squared test. The Mann-Whitney test was used to compare the mean dental plaque index between men and women, with a statistical significance threshold of α=0.05. The Pearson correlation coefficient analyzed the correlation between knowledge, attitude, behavior, and plaque status. P-values lower than 0.05 were considered statistically significant in all analyses.

Ethical considerations

The subjects participating in the study were informed about the research purpose and clearly explained it. Their participation was voluntary, and they were fully guided throughout the process. The collected data were used for research purposes only. The Biomedical Committee Research at Hue UMP approved the study.

3. RESULT

The study was conducted on 80 students, of which 15 were male (18.75%) and 65 were female (81.25%). Among the participants, 45 students (56.25%) majored in Odonto-Stomatology, while 35 students (43.75)%) were from other disciplines at Hue University of Medicine and Pharmacy.

The students were studying at Hue University of Medicine and Pharmacy during the 2022-2023 academic year.

3.1. Knowledge, attitude and oral hygiene behavior of students wearing fixed orthodontic

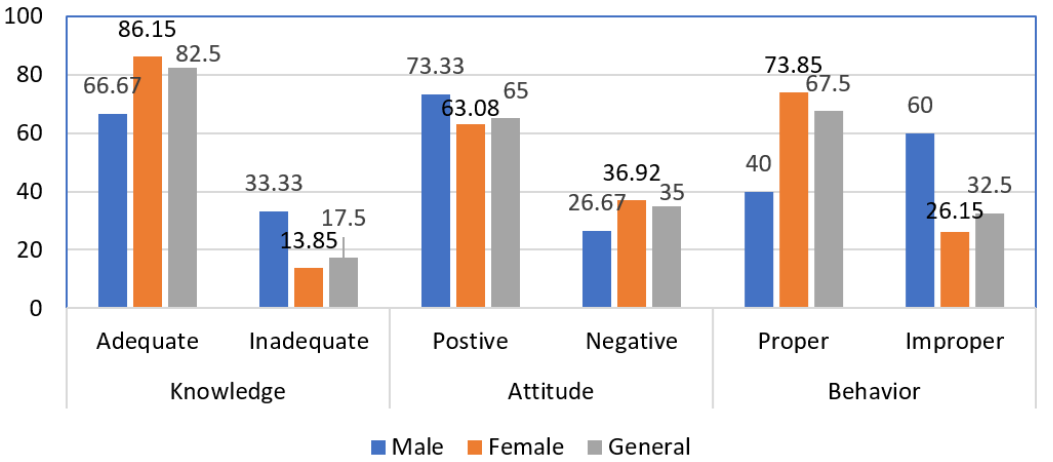
Table 2. Evaluation of some oral hygiene behaviors of students wearing fixed orthodontic (n=80)

Behavior	Gender			Major		
	Male (n, %)	Female (n, %)	Total (n, %)	Odonto-Stomatology (n, %)	Other (n, %)	Total (n, %)
Frequency of brushing teeth 2 times/day	14 (93.33)	64 (98.47)	78 (97.50)	44 (97.50)	34 (97.14)	78 (97.50)
Tooth brushing time						
< 3 minutes	5 (33.33)	23 (35.38)	28 (35.00)	19 (42.22)	9 (25.71)	28 (35.00)
3 minutes	10 (66.67)	42 (64.62)	52 (65.00)	26 (57.78)	26 (74.28)	52 (65.00)
Brushing direction						
Horizontal	0	6 (9.23)	6 (7.50)	3 (6.67)	3 (8.57)	6 (7.50)
Vertical	3 (20.00)	10 (15.38)	13 (16.25)	6 (13.33)	7 (20.00)	13 (16.25)
Non-fixed order	6 (40.00)	26 (40.00)	32 (40.00)	18 (40.00)	14 (40.00)	32 (40.00)
Brush Type						
Regural toothbrushes	12 (80.00)	54 (83.08)	66 (82.50)	37 (82.22)	29 (82.86)	66 (82.50)
Electronic toothbrushes	3 (20.00)	11 (16.92)	14 (17.50)	8 (17.78)	6 (17.14	14 (17.50)
Time to change tooth-brush						
Three months/time	11 (73.33)	47 (72.31)	58 (72.50)	33 (73.33)	25 (71.43)	58 (72.50)
Use Fluoride Toothpaste	14 (93.33)	58 (89.23)	72 (90.00)	44 (97.78)	28 (80.00)	72 (90.00)
Complementaly cleaning tools						
Dental floss	9 (60.00)	40 (61.53)	49 (61.25)	27 (60.00)	27 (60.00)	49 (61.25)
Interdental brush	9 (60.00)	37 (56.92)	46 (57.50)	23 (51.11)	23 (31.11)	46 (57.50)
Mouthwash	12 (80.00)	40 (61.54)	52 (65.00)	27 (60.00)	25 (71.43)	52 (65.00)

The study results from Table 2 showed that:

Gender differences: Most of the study subjects brushed their teeth ≥2 times/day (>93.33%); the brushing time ≥3 minutes was higher in men (66.67%) than in women (64.62%). Regarding the brushing pattern, students who brushed their teeth without a fixed pattern accounted for the highest percentage, with 40.0% in both male and female students. The majority of students used regular toothbrushes (>80.0%), used fluoride toothpaste (>89.23%), and the rate of changing toothbrushes every three months in male students (73.33%) was higher than in female students (72.31%). In general, students used complementary oral hygiene tools, with mouthwash being used the most (>61.54%), followed by dental floss (>60.0%), and finally, interdental brushes (>56.92%).

Differences by major: Most study participants had a brushing frequency of ≥2 times/day (>97.14%). Students of other majors had a higher rate of brushing for ≥ 3 minutes (74.28%) compared to Odonto-Stomatology students (57.78%). Brushing without a fixed pattern accounted for the highest rate, with 40.0% in Odonto-Stomatology students and other majors. The majority of students used a regular toothbrush (>82.22%). The rate of fluoride toothpaste use among Odonto-Stomatology students (97.78%) was much higher than that of students in other majors (80.0%). The percentage of students who changed their toothbrush every three months was similar, with 73.33% of Odonto-Stomatology students and 71.43% of students from other majors. Regarding the use of complementary oral hygiene tools, the majority of students used mouthwash (>60.0%), followed by dental floss (60.0%), and finally, interdental brushes (>31.11%).



**Using the Chi-squared test*

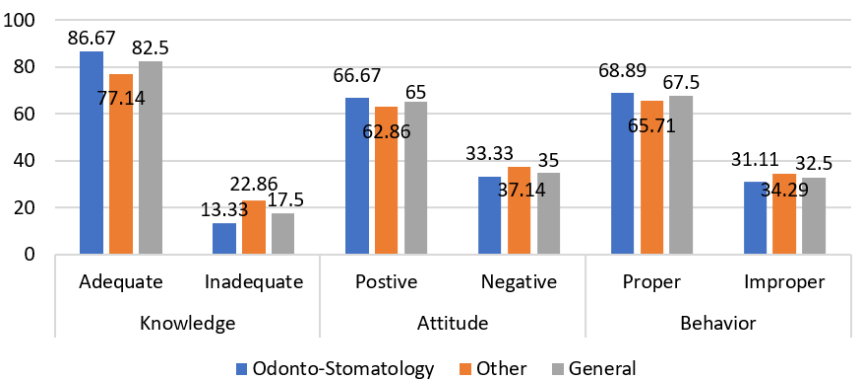
Figure 2. Assessment of the level of knowledge, attitude, and oral hygiene behavior of students wearing fixed orthodontic by gender (n=80)

Results from Figure 2 showed that female students had better oral hygiene knowledge, attitudes, and behaviors than male students.

Regarding oral hygiene, 86.15% of female students had satisfactory knowledge, while 33.33% of male students had inadequate knowledge. The difference in oral hygiene knowledge between men and women was not statistically significant (p>0.05).

73.33% of male students had a positive attitude regarding oral hygiene attitudes. However, the proportion of female students with a less positive attitude was relatively high at 36.92%. The difference in oral hygiene attitudes between male and female students was insignificant (p>0.05).

Regarding oral hygiene behavior, the percentage of students who had correct oral hygiene behavior was still low. Only 73.85% of female students had correct behavior, while up to 60.0% of male students had incorrect behavior. The difference in oral hygiene behavior between male and female students was statistically significant (p<0.05, p=0.012).



**Using the Chi-squared test*

Figure 3. Evaluation of the level of knowledge, attitude, and oral hygiene behavior of students wearing fixed orthodontic by majors (n=80)

Results from Figure 3 showed:

Regarding oral hygiene knowledge, the percentage of students majoring in Dentistry with satisfactory knowledge (86.67%) was higher than that of students in other majors (77.14%).

Regarding oral hygiene attitude, 66.67% of students majoring in Dentistry had a positive attitude, while 62.86% of students in other majors had a negative attitude toward oral hygiene.

The rate of correct oral hygiene behavior was not high in general. Dentistry students had a higher rate of proper behavior (68.89%) than other majors (65.71%).

The difference in knowledge, attitude, and

behavior between Dental and Maxillofacial students and students of other majors was not statistically significant (p>0.05).

3.2. The status of plaque on teeth and the relationship with knowledge, attitude, and oral hygiene behavior of students wearing fixed orthodontic

Table 3. Plaque index on teeth in students wearing fixed orthodontic.

Plaque properties	Immature plaque	Mature plaque	Overall plaque index
	Mean SD	*Mean SD*	*Mean SD*
Male	0.625 0.347	0.452 0.341	0.914 0.464
Female	0.781 0.242	0.584 0.323	1.005 0.401
General	0.751 0.270	0.559 0.328	0.988 0.412
p-value	0.130	0.104	0.621

**Using the Mann-Whitney test*

Results from Table 3 showed that female students had higher plaque status than male students. Specifically, the condition of immature plaque in female students (0.781 ± 0.242) was higher than that of male students (0.625 ± 0.347). Regarding mature plaque, the condition of mature plaque in female students (0.584 ± 0.323) was higher than that of male students (0.452 ± 0.341). The difference in plaque status between male and female student groups was not statistically significant (p>0.05).

Table 4. Plaque index on teeth in students wearing fixed orthodontic.

Plaque properties	Immature plaque	Mature plaque	Overall plaque index
	Mean SD	*Mean SD*	*Mean SD*
Odonto-Stomatology	0.688 0.291	0.471 0.327	0.905 0.457
Other	0.833 0.217	0.672 0.298	1.095 0.320
General	0.751 0.270	0.559 0.328	0.988 0.412
p-value	0.014	0.005	0.069

**Using the Mann-Whitney test*

The plaque status in other major students was higher than in Odonto-Stomatology students. Specifically, the condition of immature plaque in other major students (0.833 ± 0.217) was higher than that of Odonto-Stomatology students (0.688 ± 0.291). Regarding mature plaque, the condition of mature plaque in other students (0.672 ± 0.298) was higher than that of Odonto-Stomatology students (0.471 ± 0.327). The difference in immature and mature plaque status between the student groups was statistically significant (p<0.05).

Table 5. The relationship between knowledge, attitude, the behavior of oral hygiene, and plaque status.

	Knowledge	Attitude	Behavior
Plaque status	0.307	-0.107	0.022
p-value	**0.005**	0.344	0.843

**Using Pearson Correlation Coefficient*

A moderate, positive correlation between oral hygiene knowledge and plaque status was statistically significant, with p=0.005. However, no correlation was found between plaque status and attitudes or behaviors related to oral care.

4. DISCUSS

The survey was conducted on 80 Hue University of Medicine and Pharmacy students wearing fixed orthodontic, with the age of the research sample being 18-24 and the average age being 22.7 ± 0.17.

4.1. Knowledge, attitude, and oral hygiene behavior of students wearing fixed orthodontic

Our study showed that most of the participants brushed their teeth at least twice a day (≥ 93.33%) with fluoride toothpaste (≥80.0%), and ≥80.0% used a regular toothbrush. Typically, ≥57.78% had brushing times ≥3 minutes. Our results were lower than those in Ke Yao's (2019) study on "Assessment of the Oral Health Behavior,

knowledge, and Status among dental and medical undergraduate students," which found that 97.8% of students brushed their teeth at least twice a day [8]. There was a difference with the study by Jun Guo (2020) on "Knowledge and behavior of oral health of orthodontic customers in China and New Zealand," where 80% of subjects brushed their teeth at least twice a day, 88.6% used fluoride-containing toothpaste, and 85.1% used a regular toothbrush for brushing [9].

The participants in our study used complementary cleaning tools, of which mouthwash was used the most (≥60.0%), followed by dental floss (≥60.0%) and interdental brushes (≥31.11%). This result was much higher than that of Jun Guo's (2020) study, where only 35% of customers used mouthwash, 15.3% used interdental brushes, and 10.2% used dental floss [9]. This difference may have been due to age, characteristics, and the number of study subjects.

Results from Figure 2 and Figure 3 showed that although students had pretty good knowledge about oral hygiene (82.5%), their attitudes (65.0%) and behavior (67.5%) related to oral hygiene were generally at a much lower level. This result differed from the knowledge and attitude scores. Still, it was similar to the behavior scores in the study by Hoang Bao Duy et al. (2022) on "Knowledge, attitudes, practices, and status of Oral and Maxillofacial students at Hanoi Medical University," which found that 41.6% of students had good knowledge, 88.8% had good attitudes, and 44% had good oral hygiene behavior [10]. The difference between knowledge, attitude, and behavior scores showed that, although some people had good oral hygiene knowledge, their oral hygiene behavior needed improvement. This highlighted the importance of oral hygiene instructions, especially for people wearing orthodontic braces.

4.2. The status of plaque on teeth and the relationship with knowledge, attitude, and oral hygiene behavior of students wearing fixed orthodontic

According to the research results in Table 3 and Table 4 on the plaque index of students wearing fixed orthodontic appliances, the plaque index was 0.988 ± 0.412. This was lower than the research results of Nguyen Thi Huynh Dung (2019) in "Comparison of the effectiveness of direct oral hygiene instruction and videotape on patients with fixed orthodontics," which showed an overall plaque index of 1.06 ± 0.37 [12]. It was also lower than the study by M. Shilpa et al. (2019) on "Efficacy of Three Types of Plaque Control Methods During Fixed Orthodontic Treatment: A Randomized Controlled Trial," which reported a plaque index of 1.2 ± 0.32 for patients wearing fixed orthodontics between the ages of 13 and 30 [11]. This difference may have been because our research subjects were health students exposed to healthcare knowledge, resulting in lower plaque levels on their teeth.

Regarding the relationship between plaque status and knowledge, attitude, and oral hygiene behavior of students wearing fixed braces, our study found only a moderate positive association between plaque status and oral hygiene knowledge. However, practicing good oral hygiene was essential during orthodontic treatment to prevent the development of oral diseases [12]. Regular enhancement of oral hygiene and motivation, not only at the beginning of orthodontic treatment but throughout the entire treatment period, should have been implemented as it had been shown to improve hygiene attitudes and behaviors in patients' oral health [13], [14].

5. CONCLUSION

Knowledge, attitude, and behavior regarding oral hygiene are important factors that directly affect the effectiveness of the orthodontic process. Therefore, it is necessary to promote the provision of correct and adequate oral hygiene knowledge, attitudes, and behaviors to improve the oral health of healthcare students, who will impact the community's health.

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