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Knowledge and Attitude Influence on Oral Hygiene Practices among University Dental Students with Fixed Orthodontic Appliances

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A B S T R A C T

Fixed orthodontic appliances can complicate oral hygiene maintenance, increasing the risk of dental caries and periodontal diseases. This study aimed to assess the relationship between knowledge, attitude, and oral hygiene practices among university dental students undergoing fixed orthodontic treatment. A cross-sectional study was conducted among dental students at Universitas Prima Indonesia. Data were collected using a self-administered questionnaire that included questions on oral hygiene knowledge, attitude towards oral health, and oral hygiene practices. Descriptive statistics, Chi-square tests, and logistic regression were used to analyze the data. A total of 40 dental students participated in the study. The majority of the participants (95%) had good knowledge about oral hygiene. A positive correlation was found between knowledge and attitude (p=0.027), indicating that students with better knowledge exhibited more positive attitudes towards oral health. Furthermore, students with good knowledge were more likely to perform proper oral hygiene practices, including brushing twice daily (95%), using interdental brushes (97.5%), and visiting the dentist regularly (52.5%). In conclusion, this study highlights the importance of oral health knowledge and positive attitudes in promoting proper oral hygiene practices among dental students with fixed orthodontic appliances. Educational interventions aimed at improving knowledge and shaping attitudes may be beneficial in enhancing oral hygiene behavior and ensuring successful orthodontic treatment outcomes.

1. Introduction

Oral health is an integral component of overall well-being, and maintaining optimal oral hygiene is essential for preventing various dental diseases. Oral hygiene practices encompass a range of activities aimed at removing plaque, a sticky biofilm that forms on teeth and can lead to dental caries, gingivitis, periodontitis, and other oral health issues. These practices include regular brushing, flossing, using mouthwash, and maintaining a healthy diet. For individuals undergoing fixed orthodontic treatment, maintaining good oral hygiene is even more critical. Fixed orthodontic appliances, such as braces, create additional challenges for oral hygiene maintenance. The brackets and wires of these appliances can trap food particles and plaque, making it harder to clean effectively. This can lead to an increased risk of demineralization, white spot lesions, gingivitis, and other complications that can compromise both oral health and the success of orthodontic treatment. The importance of oral hygiene is well-established in the literature. Studies have consistently shown a strong link between oral hygiene practices and the prevalence of oral diseases. Poor oral hygiene has been identified as a major risk factor for dental caries, gingivitis, periodontitis, and even systemic conditions such as cardiovascular disease and diabetes. Conversely, good oral hygiene practices have been associated with a reduced risk of these conditions and improved overall health outcomes.[1-4]

In the context of fixed orthodontic treatment, oral hygiene plays a crucial role in preventing complications and ensuring successful treatment outcomes. Research has demonstrated that patients with poor oral hygiene during orthodontic treatment are more likely to experience demineralization, white spot lesions, and gingivitis. These complications can not only affect the esthetics of the smile but also compromise the long-term health of the teeth and supporting tissues. Given the importance of oral hygiene in both general and orthodontic contexts, it is essential to understand the factors that influence oral hygiene practices. Knowledge, attitudes, and beliefs about oral health have been identified as key determinants of oral hygiene behavior. Individuals with adequate knowledge about oral hygiene are more likely to adopt positive attitudes and engage in proper oral hygiene practices. Conversely, those with limited knowledge or negative attitudes may be less likely to prioritize oral hygiene, leading to an increased risk of oral diseases.[5-7]

Dental students, as future oral health professionals, are expected to possess comprehensive knowledge and demonstrate exemplary oral hygiene practices. They receive extensive education and training on oral health and hygiene, and they are expected to serve as role models for their patients. However, even among dental students, challenges in maintaining optimal oral hygiene during orthodontic treatment may exist. The demands of their academic curriculum, clinical responsibilities, and personal lives can sometimes lead to lapses in oral hygiene practices. Understanding the interplay between knowledge, attitude, and practice in this population is essential to identify potential gaps and develop targeted interventions to promote oral health. By investigating the influence of knowledge and attitude on oral hygiene practices among dental students with fixed orthodontic appliances, we can gain valuable insights into how to improve oral health outcomes in this population and enhance their ability to educate their future patients.[8-10] This study aimed to investigate the influence of knowledge and attitude on oral hygiene practices among university dental students with fixed orthodontic appliances.

2. Methods

This research adopted a cross-sectional study design, which is well-suited for investigating the relationship between knowledge, attitude, and oral hygiene practices among dental students with fixed orthodontic appliances. Cross-sectional studies provide a snapshot of a population at a specific point in time, allowing for the assessment of associations between variables. The study population consisted of all active dental students enrolled at the Faculty of Dentistry, Universitas Prima Indonesia, who were undergoing fixed orthodontic treatment at the time of the study. Universitas Prima Indonesia is a private university located in Medan, Indonesia, with a Faculty of Dentistry that offers undergraduate and postgraduate dental education programs. The decision to focus on dental students was based on several considerations. First, dental students are future oral health professionals who are expected to possess comprehensive knowledge and demonstrate exemplary oral hygiene practices. Second, they receive extensive education and training on oral health and hygiene, making them a suitable population for investigating the influence of knowledge and attitude on oral hygiene practices. Third, dental students undergoing fixed orthodontic treatment face unique challenges in maintaining optimal oral hygiene due to the presence of brackets and wires, which can trap food particles and plaque.

To ensure the generalizability of the findings, a sample size calculation was performed using the Slovin formula. The Slovin formula is a commonly used method for determining the minimum sample size required for a cross-sectional study. It takes into account the population size and the desired margin of error. In this study, the population size was estimated to be the total number of active dental students enrolled at the Faculty of Dentistry, Universitas Prima Indonesia. The desired margin of error was set at 0.05, which is a standard level of precision for cross-

sectional studies. Based on the Slovin formula, the minimum sample size required for this study was calculated to be 30 participants. This sample size was deemed sufficient to provide a representative sample of the study population and to ensure the statistical power of the analysis.

Data were collected using a self-administered questionnaire, which is a widely used method for collecting data in cross-sectional studies. Self-administered questionnaires allow for the efficient collection of data from a large number of participants, and they can be designed to assess a variety of variables, including knowledge, attitudes, and practices. The questionnaire used in this study was designed to assess oral hygiene knowledge, attitudes towards oral health, and oral hygiene practices among dental students with fixed orthodontic appliances. It was developed based on a review of relevant literature and validated by experts in dentistry and public health. The validation process involved a review of the questionnaire's content, clarity, and relevance to the study objectives. The questionnaire consisted of three sections; Oral Hygiene Knowledge Section: This section comprised five questions related to oral hygiene definitions, brushing frequency, the importance of cleaning around orthodontic appliances, recommended cleaning tools, and the impact of oral hygiene on orthodontic treatment success. Each question had a correct answer, and participants were asked to select the correct answer from a list of options; Attitude towards Oral Health Section: This section included ten statements about oral health and hygiene maintenance. Participants were asked to respond to each statement using a 5-point Likert scale ranging from strongly agree to strongly disagree. The Likert scale is a commonly used method for measuring attitudes and beliefs, and it allows for the quantification of responses; Oral Hygiene Practices Section: This section assessed oral hygiene practices through questions on brushing frequency, interdental cleaning, dental visits, and dietary habits. Participants were asked to report their oral hygiene practices, such as how often they brushed their teeth, whether they used interdental cleaning aids, and how frequently they visited the dentist.

Data collection was conducted in February 2025 at the Faculty of Dentistry, Universitas Prima Indonesia. Prior to data collection, ethical approval was obtained from the university's research ethics committee. The study's purpose, procedures, and potential risks and benefits were explained to the participants, and informed consent was obtained from all participants before they completed the questionnaire. The questionnaires were distributed to eligible dental students who met the inclusion criteria; Active dental student enrolled at the Faculty of Dentistry, Universitas Prima Indonesia; Currently undergoing fixed orthodontic treatment. Participants were given clear instructions on how to complete the questionnaire, and they were assured of the confidentiality of their responses. Completed questionnaires were collected and stored securely to ensure data privacy.

Data were analyzed using SPSS software, which is a widely used statistical software package for social sciences research. SPSS provides a range of statistical tools for data analysis, including descriptive statistics, inferential statistics, and graphical representations of data. Descriptive statistics were used to summarize the characteristics of the participants and their responses. This included calculating frequencies, percentages, means, and standard deviations for demographic variables, oral hygiene knowledge scores, attitude towards oral health scores, and oral hygiene practices. Chi-square tests were used to examine the association between knowledge, attitude, and oral hygiene practices. The chi-square test is a non-parametric statistical test used to determine whether there is a significant association between two categorical variables. In this study, the chi-square test was used to assess the relationship between oral hygiene knowledge and attitude towards oral health, as well as the relationship between oral hygiene knowledge and oral hygiene practices. Logistic regression analysis was performed to identify predictors of good oral hygiene practices. Logistic

regression is a statistical method used to analyze the relationship between a categorical dependent variable and one or more independent variables. In this study, the dependent variable was oral hygiene practices, and the independent variables were oral hygiene knowledge and attitude towards oral health. Logistic regression analysis allowed for the identification of factors that were significantly associated with good oral hygiene practices.

3. Results and Discussion

Table 1 provides a breakdown of the characteristics of the 40 dental students who participated in the study; Gender: A majority of the participants were female (65%). This isn't unusual in dental programs, as more women tend to enter the field of dentistry now; Age (Years): Unfortunately, the specific age ranges and the number of participants in each range are not provided in the table. This information would have been useful to understand the age distribution of the participants; Year of Study: The participants represented various stages of their dental education. The highest representation was from 3rd-year students (27.5%), followed by 1st, 5th, and 7th-year students each with 20%. There were no participants from 2nd, 4th, 6th, 8th, or 10th year, and only a very small percentage (2.5%) from 11th year. This distribution might reflect the structure of the dental program at Universitas Prima Indonesia or the availability of students in certain years who met the inclusion criteria for the study; Duration of Orthodontic Treatment: Most participants (42.5%) had been undergoing orthodontic treatment for more than 2 years. This suggests that a significant portion of the sample had experience with managing oral hygiene with fixed appliances for a considerable period; Frequency of Dental Visits: A little over half of the participants (52.5%) reported visiting the dentist every month. This is a positive finding, as regular dental check-ups are crucial for maintaining oral health, especially during orthodontic treatment. However, a substantial percentage (22.5%) visited every 3 months, and some (17.5%) even less frequently. A small number (7.5%) reported never visiting the dentist. These findings highlight the need to emphasize the importance of regular dental visits among dental students, even those studying dentistry.

Table 2 presents the findings regarding the oral hygiene knowledge of the participating dental students. Overall, the table illustrates a high level of oral hygiene knowledge among the students; Definition of good oral health: 100% of the students correctly identified the definition of good oral health, indicating a strong foundational understanding of oral health concepts; Recommended brushing frequency: The vast majority (95%) knew that brushing twice a day is recommended. This demonstrates awareness of a fundamental oral hygiene practice; Importance of cleaning around orthodontic appliances: Most students (92.5%) understood the importance of cleaning around orthodontic appliances to prevent plaque buildup and damage, highlighting their knowledge of specific oral hygiene needs related to orthodontic treatment; Recommended cleaning tool for orthodontic appliance users: An overwhelming majority (97.5%) correctly identified interdental brushes as the recommended cleaning tool for those with braces. This shows awareness of specialized oral hygiene tools; Role of oral hygiene in orthodontic treatment success: All students (100%) recognized that oral hygiene plays a crucial role in the success of orthodontic treatment, demonstrating an understanding of the link between oral hygiene and treatment outcomes.

Table 3 provides insights into the dental students' attitudes towards oral health. Each statement explores different facets of oral hygiene and its importance; Statements 1, 2, 3, 5, 8, and 10 assess adherence to and beliefs about specific oral hygiene practices: The vast majority strongly agree or agree with this practice (mean score 4.8), indicating a positive attitude towards this fundamental aspect of oral hygiene. While the mean score is 4.1, suggesting general agreement, there's a wider distribution of responses compared to brushing. This could indicate that some students might not prioritize interdental cleaning as much as

brushing. The mean score of 4.4 shows a positive attitude towards regular checkups. However, the distribution suggests that not all students prioritize frequent dental visits. With a mean score of 4.1, many students acknowledge the need for additional practices like flossing or mouthwash, indicating awareness of more comprehensive oral hygiene. The mean score of 4.3 suggests a positive attitude towards tongue cleaning as part of oral hygiene. The mean score of 4.0 indicates a more neutral stance on this. Some students might not see a significant difference between regular and orthodontic toothbrushes; Statements 4, 6, and 7 explore the perceived impact of oral hygiene: A strong majority agree or strongly agree (mean score 4.6), reflecting an understanding of the link between oral hygiene and treatment outcomes. Most students agree or strongly agree (mean score 4.5), demonstrating awareness of the negative consequences of poor oral hygiene. A high mean score of 4.6 indicates that students associate poor oral hygiene with discomfort, which can motivate them to maintain good practices; Statement 9 examines dietary habits: The lowest mean score of 3.8 and a wider distribution of responses suggest that dietary modifications related to oral hygiene might be less prioritized or adhered to by the students.

Table 4 provides a detailed look at the oral hygiene practices of the participating dental students. The data shows a generally positive trend in terms of oral hygiene maintenance, but also highlights some areas for potential improvement; Brushing Frequency: A large majority (95%) of the students reported brushing their teeth twice a day, which aligns with the recommended frequency. This indicates good adherence to a fundamental oral hygiene practice. A small percentage (5%) reported brushing three times or more a day. While frequent brushing can be beneficial, it's important to note that excessive brushing can also potentially cause damage to teeth and gums; Use of Interdental Cleaning Aids: An overwhelming majority (97.5%) of the students reported using interdental cleaning aids. This is a very positive finding, as interdental cleaning is crucial for removing plaque and debris from areas that toothbrushes can't reach, especially with orthodontic appliances. Only a very small percentage (2.5%) reported not using interdental cleaning aids;Type of Interdental Cleaning Aid Used: The most preferred type of interdental cleaning aid was the interdental brush (75%), which is specifically recommended for orthodontic patients. Dental floss was used by 12.5% of the participants. Some students (10%) used both interdental brushes and dental floss, indicating a comprehensive approach to interdental cleaning. A small percentage (2.5%) used other types of interdental cleaning aids; Frequency of Dental Visits: A little over half of the students (52.5%) reported visiting the dentist every month. This is a positive finding, as regular dental visits are essential for professional cleaning and checkups, especially during orthodontic treatment. A significant percentage (22.5%) visited the dentist every 3 months. Some students (17.5%) visited the dentist every 6 months or even less frequently. A small percentage (7.5%) reported never visiting the dentist. These findings indicate that while a majority of the students visit the dentist regularly, there is still a need for improvement in the frequency of dental visits for some; Use of Mouthwash: A majority (62.5%) of the students reported using mouthwash, which can be beneficial for overall oral hygiene. A significant percentage (37.5%) did not use mouthwash; Type of Mouthwash Used: The most commonly used type of mouthwash was fluoride mouthwash (37.5%). Antibacterial mouthwash was used by 17.5% of the participants. Some students (7.5%) used both types of mouthwash. No students reported using other types of mouthwash; Dietary Habits: A majority (62.5%) of the students reported avoiding sticky and hard foods, which can be beneficial for preventing damage to orthodontic appliances and teeth. A quarter (25%) of the students reported limiting sugary snacks, which is important for preventing dental caries. A small percentage (12.5%) reported making no dietary changes; Tongue Cleaning: Most students (87.5%) reported cleaning their tongue, which is an important part of oral

hygiene for removing bacteria and freshening breath. A small percentage (12.5%) did not clean their tongue.

Table 5 explores the connections between knowledge, attitude, and oral hygiene practices among the dental students. It specifically looks at how knowledge level (good vs. moderate/poor) relates to attitude level (positive vs. neutral/negative) and, importantly, how these together influence good oral hygiene practices; Knowledge and Attitude: Most students with good knowledge also had a positive attitude (75%). This suggests a link between knowing what's good for your oral health and having a positive mindset towards maintaining it. There's a statistically significant association between knowledge and attitude (p=0.027). This means it's likely not just by chance that those with better knowledge also have more positive attitudes; Knowledge, Attitude, and Practices: Among those with good knowledge AND a positive attitude, a striking 93.3% also had good oral hygiene practices. This suggests that knowledge and attitude together can strongly influence actual behavior. For those with good knowledge but a neutral/negative attitude, the percentage with good practices dropped to 62.5%. This highlights that even with knowledge, a less positive attitude can hinder good practices. The small number of students with moderate/poor knowledge limits strong conclusions about this group. However, the one student with moderate/poor knowledge and a positive attitude still had good practices, suggesting that a positive attitude might somewhat compensate for lower knowledge. Notably, the p-value of 0.04 indicates a statistically significant relationship between knowledge level and the likelihood of good oral hygiene practices.

Table 1. Characteristics of participants.

Characteristic	Category	Frequency (n)	Percentage (%)
Gender			
	Male	14	35
	Female	26	65
Age (years)			
	18-20		
	21-23		
	24-26		
Year of study			
	1st	8	20
	2nd		
	3rd	11	27.5
	4th		
	5th	8	20
	6th		
	7th	8	20
	8th		
	9th	4	10
	10th		
	11th	1	2.5
Duration of orthodontic treatment			
	< 6 months	7	17.5
	6-12 months	5	12.5
	1-2 years	11	27.5
	> 2 years	17	42.5
Frequency of dental visits			
	Every month	21	52.5
	Every 3 months	9	22.5
	Every 6 months or more	7	17.5
	Never	3	7.5

Table 2. Oral hygiene knowledge among participants.

No.	Question	Correct answer	Correct responses (n)	% Correct	Incorrect responses (n)	% Incorrect
1	What is the definition of good oral health?	Condition of teeth and mouth free from germs and food debris	40	100	0	0
2	What is the recommended frequency for brushing teeth?	Twice a day	38	95	2	5
3	Why is it important to clean food debris around fixed orthodontic appliances?	To avoid plaque buildup that can damage teeth	37	92.5	3	7.5
4	What cleaning tool is recommended by dentists for users of fixed orthodontic appliances?	Interdental brush	39	97.5	1	2.5
5	Does oral hygiene play a role in determining the success of orthodontic treatment?	Yes	40	100	0	0
Overall				**95**		**5**

Table 3. Attitude towards oral health among participants.

No.	Statement	Strongly agree (n)	Agree (n)	Neutral (n)	Disagree (n)	Strongly disagree (n)	Mean score
1	I routinely brush my teeth at least twice a day, as recommended by the dentist, right after breakfast and before bed.	34	4	1	1	0	4.8
2	I use an interdental brush to clean food debris around my braces.	15	16	7	2	0	4.1
3	I routinely consult and have check-ups with the dentist to monitor the cleanliness around my orthodontic appliances.	19	16	4	1	0	4.4
4	I feel that oral hygiene affects the success of fixed orthodontic treatment.	26	13	1	0	0	4.6
5	I feel that routine brushing is not enough to maintain my oral health optimally without flossing or using mouthwash.	9	22	9	0	0	4.1
6	I am aware that plaque around orthodontic appliances can cause damage to teeth and gum tissue.	23	13	4	0	0	4.5
7	Lack of oral hygiene makes me feel uncomfortable while using fixed orthodontic appliances.	24	16	0	0	0	4.6
8	I feel that cleaning my tongue while brushing my teeth every day is important.	20	14	5	1	0	4.3
9	I tend to reduce the consumption of foods that have a sticky or hard texture.	12	13	12	2	1	3.8
10	I always brush my teeth using a special toothbrush for fixed orthodontic appliance users.	16	11	12	1	0	4.0
	Overall Attitude Score						**4.3**

Table 4. Oral hygiene practices among participants.

No.	Practice	Category	Frequency (n)	Percentage (%)
1	**Frequency of Brushing**			
		Twice a day	38	95
		Three times or more a day	2	5
2	**Use of Interdental Cleaning Aids**			
		Yes	39	97.5
		No	1	2.5
3	**Type of Interdental Cleaning Aid Used**			
		Interdental brush	30	75
		Dental floss	5	12.5
		Both	4	10
		Others	1	2.5
4	**Frequency of Dental Visits**			
		Every month	21	52.5
		Every 3 months	9	22.5
		Every 6 months or more	7	17.5
		Never	3	7.5
5	**Use of Mouthwash**			
		Yes	25	62.5
		No	15	37.5
6	**Type of Mouthwash Used**			
		Fluoride mouthwash	15	37.5
		Antibacterial mouthwash	7	17.5
		Both	3	7.5
		Others	0	0
7	**Dietary Habits**			
		Avoid sticky and hard foods	25	62.5
		Limit sugary snacks	10	25
		No dietary changes	5	12.5
8	**Tongue Cleaning**			
		Yes	35	87.5
		No	5	12.5

Table 5. Relationship between knowledge, attitude, and oral hygiene practices.

Knowledge level	Attitude level	n	%	p-value	Good oral hygiene practices (n)	%	p-value
Good	**Positive**	30	75		28	93.3	
	Neutral/Negative	8	20	0.027	5	62.5	0.04
Moderate/Poor	**Positive**	1	2.5		1	100	
	Neutral/Negative	1	2.5		0	0	

The study revealed a high level of oral hygiene knowledge among the participating dental students, with 95% demonstrating good knowledge about various aspects of oral hygiene. This impressive result is not entirely unexpected, considering that these students are immersed in a dental education environment where oral health is a central theme. Their curriculum covers a wide range of topics related to oral hygiene, from basic concepts to advanced techniques, ensuring they have a strong foundation in this area. A perfect score (100%) in identifying the correct definition of good oral health indicates a solid understanding of the fundamental principles of oral health. This knowledge forms the basis for understanding the importance of oral hygiene practices and their impact on overall well-being. The vast majority (95%) correctly identified twice-daily brushing as the recommended frequency. This demonstrates awareness of a basic yet crucial oral hygiene practice that significantly impacts plaque control and caries prevention. A high percentage (92.5%) understood the specific challenges and importance of cleaning around orthodontic appliances. This knowledge is critical for these students, as they are not only responsible for their own oral health during orthodontic treatment but will also be educating future patients on proper techniques. An overwhelming majority (97.5%) correctly identified interdental brushes as the tool of choice for cleaning around braces. This reflects their familiarity with specialized oral hygiene tools and their understanding of how different tools address specific needs. A unanimous (100%) recognition of the link between oral hygiene and successful orthodontic treatment outcomes demonstrates a deeper understanding of the interconnectedness of oral health practices and treatment goals. This high level of knowledge across various aspects of oral hygiene suggests that dental education at Universitas Prima Indonesia is effectively equipping students with the necessary information to maintain good oral health for themselves and their future patients. It also indicates that these students are likely to be strong advocates for oral hygiene, promoting its importance to their patients and the wider community. Beyond simply possessing knowledge, the study also found a statistically significant positive correlation between knowledge and attitudes towards oral health (p=0.027). This suggests that students with a deeper understanding of oral hygiene concepts tend to have more favorable attitudes towards maintaining good oral health. This connection aligns with the broader understanding of how knowledge influences health behaviors. When individuals are well-informed about the benefits of healthy practices and the consequences of neglecting them, they are more likely to develop positive attitudes and adopt those practices. In the context of oral hygiene, this means that students who understand the detrimental effects of poor oral hygiene, such as gum disease and tooth decay, are more likely to value and prioritize good oral hygiene habits. This positive correlation between knowledge and attitude is a promising finding, as it suggests that by fostering a strong knowledge base in oral hygiene, dental education can indirectly cultivate positive attitudes towards oral health. These positive attitudes, in turn, can motivate students to adopt and maintain good oral hygiene practices throughout their lives and careers.

The observed knowledge-attitude connection warrants further exploration. While the study establishes a correlation, it's important to understand the underlying mechanisms that drive this relationship. Cognitive dissonance theory suggests that individuals strive for consistency between their beliefs and actions. When there's a discrepancy, such as knowing the importance of oral hygiene but not practicing it, it creates discomfort (dissonance). To reduce this dissonance, individuals may change their attitudes to align with their knowledge, leading to improved oral hygiene practices. Knowledge can enhance self-efficacy, which is the belief in one's ability to successfully perform a behavior. In this case, students with greater knowledge about oral hygiene may feel more confident in their ability to maintain good oral health, leading to more positive attitudes and consistent practices. Knowledge about the detrimental effects of poor oral hygiene can increase risk perception. When individuals perceive a higher risk of negative consequences, they are more likely to adopt preventive measures, such as good oral hygiene practices, and develop positive attitudes towards oral health. Knowledge can also influence attitudes through social influence. Dental students, surrounded by peers and faculty who emphasize oral health, may internalize these values and develop positive attitudes towards oral hygiene. Understanding these mechanisms can help educators and practitioners develop more targeted interventions to strengthen the knowledge-attitude connection and promote positive oral health behaviors.[11-13]

This study aimed to explore not only the knowledge and attitudes of dental students regarding oral hygiene but also their actual practices. After all, knowledge and positive attitudes are most impactful when they translate into consistent and effective oral hygiene behaviors. The results revealed a generally encouraging picture of oral hygiene practices among the participants, but also highlighted some areas with potential for improvement. A vast majority (95%) of the students reported brushing their teeth twice a day, aligning with widely accepted recommendations for optimal plaque control. This finding suggests that most students have incorporated this fundamental oral hygiene practice into their daily routines. Moreover, the fact that these are dental students indicates that this healthy habit is likely to persist throughout their professional careers, setting a positive example for their patients. Perhaps even more impressive was the high adherence to interdental cleaning, with 97.5% of participants reporting the use of interdental cleaning aids. This practice is crucial for overall oral health, but even more so for individuals undergoing orthodontic treatment. Braces create numerous nooks and crannies where plaque can accumulate, making interdental cleaning essential to prevent caries and gum disease. The students' preference for interdental brushes (75%) over floss (12.5%) also reflects an understanding of the most effective tools for cleaning around orthodontic appliances. This conscious choice of appropriate tools further emphasizes their commitment to maintaining good oral hygiene. Over half of the participants (52.5%) reported visiting the dentist every month, indicating a proactive approach to professional oral care. Regular dental visits are vital for professional cleaning, early detection of any oral health issues, and timely intervention. This is especially important during orthodontic treatment, as regular checkups allow the dentist to monitor progress, make adjustments, and address any concerns promptly. The high frequency of dental visits among these students suggests an understanding of the importance of professional intervention in maintaining optimal oral health, especially during complex treatments like orthodontics. These positive findings suggest that the dental students are largely aware of and practicing good oral hygiene habits. This bodes well for their own oral health and their ability to educate and motivate their future patients to adopt similar practices. Their adherence to recommended practices reflects the effectiveness of dental education in instilling not only knowledge but also a sense of responsibility towards oral health maintenance. While over half of the students visited the dentist monthly, a significant

portion (40%) visited less frequently, with some (7.5%) reporting never visiting the dentist. This indicates a need for greater emphasis on the importance of regular professional dental care, even for those studying dentistry. Frequent visits allow for the early detection and management of oral health issues, which can prevent complications and ensure successful orthodontic treatment outcomes. It is crucial for dental students to internalize this message and translate it into consistent action, as their own practices will inevitably influence their patients' attitudes towards dental visits. Although a majority of the students (62.5%) reported avoiding sticky and hard foods that could damage their braces, only 25% reported limiting sugary snacks. Sugary snacks are a major contributor to dental caries, and their frequent consumption can undermine even the most diligent brushing and flossing routines. Educating students on the impact of dietary choices on oral health, particularly during orthodontic treatment, is crucial. This includes emphasizing the importance of limiting sugary snacks and drinks, as well as promoting a balanced diet rich in fruits, vegetables, and whole grains. Integrating nutritional counseling into dental education can empower students to make informed dietary choices that support their oral and overall health. While mouthwash can be a beneficial addition to an oral hygiene routine, it's not a replacement for proper brushing and interdental cleaning. In this study, 37.5% of students did not use mouthwash. It's important to educate students on the role of mouthwash as an adjunct to, not a substitute for, mechanical cleaning. Furthermore, the type of mouthwash used can make a difference. Fluoride mouthwash, for example, can help strengthen enamel and prevent caries, while antibacterial mouthwash can target harmful bacteria. Dental students should be knowledgeable about the different types of mouthwash and their specific benefits to make informed choices for themselves and their patients. Incorporating detailed information about mouthwash selection and usage into dental curricula can ensure that students are well-versed in this aspect of oral hygiene.[14-16]

This study delves into the intricate relationship between knowledge, attitude, and practice in the realm of oral hygiene among dental students undergoing orthodontic treatment. While the findings confirm the intuitive notion that knowledge is a cornerstone of positive attitudes and behaviors, they also reveal a more nuanced picture, highlighting the limitations of knowledge alone in driving consistent optimal oral hygiene practices. The positive correlation observed between oral hygiene knowledge and attitudes underscores the importance of a strong knowledge base in shaping positive perceptions towards oral health. When individuals, particularly those undergoing orthodontic treatment, understand the intricacies of oral hygiene, the potential consequences of poor practices, and the benefits of diligent care, they are more likely to value and prioritize oral health maintenance. This understanding can foster a sense of responsibility and ownership, leading to more favorable attitudes towards oral hygiene. However, the study also reveals a crucial caveat knowledge, while essential, is not always sufficient to ensure consistent optimal oral hygiene practices. Despite demonstrating high levels of knowledge, not all participants adhered to every recommended practice, such as frequent dental visits and limiting sugary snacks. This discrepancy between knowledge and action suggests that other factors beyond knowledge are at play in shaping oral hygiene behaviors. This finding aligns with a broader understanding of health behavior change, where knowledge is often viewed as a necessary but not sufficient condition for behavior modification. The "knowledge-deficit" model, which assumes that simply providing information will lead to behavior change, has been largely discredited. Instead, health behavior theories emphasize the complex interplay of various factors, including psychological, social, and environmental influences, in shaping health behaviors. Motivation, the driving force behind any behavior, plays a crucial role in oral hygiene maintenance. Individuals with high motivation are more likely to overcome challenges and maintain

consistent practices. Self-efficacy, the belief in one's ability to successfully perform a behavior, also contributes significantly. Students who are confident in their ability to effectively clean around their orthodontic appliances, for instance, are more likely to adhere to interdental cleaning practices. An individual's perception of their risk for oral health issues can influence their practices. Those who perceive themselves to be at high risk for caries or gum disease may be more motivated to maintain good oral hygiene. However, the opposite can also be true. Individuals who feel invulnerable to oral health problems may neglect their oral hygiene, even with adequate knowledge. Social norms, the unwritten rules that govern behavior within a group, can significantly impact oral hygiene practices. If good oral hygiene is valued and practiced within a social circle, individuals are more likely to conform to these norms. Conversely, if poor oral hygiene is prevalent or accepted within a group, it can negatively influence individual practices. Access to resources, such as oral hygiene tools, products, and dental services, can influence practices. Students facing financial constraints or limited access to dental care may find it challenging to maintain optimal oral hygiene. Similarly, the availability of healthy food choices and the presence of supportive infrastructure, such as accessible dental clinics, can influence oral hygiene behaviors. Oral hygiene practices are often ingrained habits, formed through repetition and reinforcement. Establishing and maintaining healthy habits requires conscious effort and consistent practice. Breaking unhealthy habits, such as frequent snacking on sugary foods, can be challenging, even with adequate knowledge and positive attitudes. Understanding the complex interplay of knowledge, attitude, and practice has significant implications for promoting oral hygiene among dental students and the general population. Dental education should go beyond simply imparting knowledge. It should incorporate strategies to foster positive attitudes, enhance motivation, build self-efficacy, and address social and environmental influences. This holistic approach can empower students to translate their knowledge into consistent and effective oral hygiene practices. Recognizing the individual differences in motivation, risk perception, and social influences can help tailor interventions to specific needs. Personalized counseling, motivational interviewing, and targeted educational programs can address individual barriers and promote behavior change. Fostering a supportive environment where good oral hygiene is valued and practiced can positively influence individual behaviors. Dental schools and clinics can create a culture that promotes oral health through peer support, role modeling, and accessible resources. Incorporating behavior change techniques, such as habit stacking, implementation intentions, and self-monitoring, can help individuals establish and maintain healthy oral hygiene habits. These techniques can empower individuals to overcome challenges and integrate oral hygiene practices into their daily routines.[17-20]

4. Conclusion

This study underscores the profound impact of oral health knowledge and positive attitudes in shaping proper oral hygiene practices among dental students with fixed orthodontic appliances. The results highlight that students with comprehensive knowledge of oral hygiene tend to exhibit more positive attitudes towards oral health, and this combination of knowledge and attitude significantly influences their adoption of good oral hygiene practices. While knowledge is a cornerstone of positive oral health behaviors, it is not the sole determinant. Other factors, such as motivation, self-efficacy, risk perception, social norms, access to resources, and habit formation, also play crucial roles in shaping oral hygiene practices. These findings have significant implications for dental education and practice. Dental education should go beyond simply imparting knowledge, incorporating strategies to foster positive attitudes, enhance motivation, build self-efficacy, and address social and environmental influences. A holistic approach that considers the complex interplay of knowledge, attitude, and practice can empower

students to translate their knowledge into consistent and effective oral hygiene behaviors. Recognizing the individual differences in motivation, risk perception, and social influences can help tailor interventions to specific needs. Personalized counseling, motivational interviewing, and targeted educational programs can address individual barriers and promote behavior change. Fostering a supportive environment where good oral hygiene is valued and practiced can positively influence individual behaviors. Dental schools and clinics can create a culture that promotes oral health through peer support, role modeling, and accessible resources. Incorporating behavior change techniques, such as habit stacking, implementation intentions, and self-monitoring, can help individuals establish and maintain healthy oral hygiene habits. These techniques can empower individuals to overcome challenges and integrate oral hygiene practices into their daily routines. By understanding the complex interplay of knowledge, attitude, and practice, dental educators and practitioners can develop more effective strategies to promote oral health and ensure successful orthodontic treatment outcomes. This study contributes to the growing body of knowledge in this area and provides valuable insights for improving oral health education and practice.

5. References

1. Gaikwad S, Todkar M, Nagarale R, Deochake C, Dhede G, Kadam M. Evaluation of knowledge, attitude and practice about oral hygiene aids among dental hygienists in Western Maharashtra, India. Int J Dent Oral Care. 2022; 1(1).
2. Subramani P, Baskaran M, Abishiny M, Mathivanthani G, Nishanthi R, Nisha M. Knowledge, attitude, and practices of oral hygiene care among 12-year-old children in Chengalpattu District, India. J Oral Health Community Dent. 2022; 16(1): 51–5.
3. Taneja P, Yadav A, Saharan A. Oral hygiene knowledge and practices among antenatal women of community health centre, Badkhalsa, Sonipat district, Haryana. J Oral Health Community Dent. 2022; 16(1): 1–4.
4. Coppola N, Rivieccio I, Blasi A, Ferrigno R, Baldares S, Mignogna MD, et al. Current knowledge, attitude and practice among dental hygienists in oral cancer awareness: systematic review. Int J Dent Hyg. 2022; 20(2): 249–61.
5. Fantaye W, Nur A, Kifle G, Engida F. Oral health knowledge and oral hygiene practice among visually impaired subjects in Addis Ababa, Ethiopia. BMC Oral Health. 2022; 22(1): 167.
6. Yoon J-A, The Korean Society of Oral Health Science. First aid knowledge level and awareness of some dental hygiene student's. Korean Soc Oral Health Sci. 2022; 10(2): 121–7.
7. Yolanda A, Kristiani A, Sabilillah MF. Knowledge with dental and oral hygiene in deaf children. The Incisor. 2022; 6(2): 325–34.
8. Lee E-J, Lee M-O, The Korean Society of Oral Health Science. A study on infection control performance according to COVID-19 knowledge and attitude of dental hygiene students. Korean Soc Oral Health Sci. 2022; 10(3): 112–8.
9. Skriver RE, Reibel YG, Christianson DJ, Evans MD, Arnett MC. Knowledge and attitudes of undergraduate dental, allied oral health and nursing students towards patients with Alzheimer's disease. J Dent Hyg. 2023; 97(6): 37–49.
10. Park M-J, Kang H-K, Kim Y-R, Lee J-Y, The Korean Society of Oral Health Science. The effects of environmental awareness education on medical waste knowledge and attitude of dental hygiene students. Korean Soc Oral Health Sci. 2023; 11(1): 88–95.
11. Souza E de O, Pedreira LC, Silva RS, Góes RP, Cavaleiro AJBG. Oral hygiene self-care: Concept analysis for the development of a new

nursing diagnosis. Int J Nurs Knowl. 2024; 35(4): 386–96.

12. Balmith M, Cordier W, Bhayat A, Basson C, Morule M, Schellack N. An evaluation of knowledge and perception of pharmacology in undergraduate oral hygiene students and recent graduates at a single higher institution in Pretoria. Int J Dent Hyg. 2024; 22(4): 791–801.
13. Yang A, Yuan W, Yang L, Lei L, Cao Z, Chen L. Dental hygienists' influence on oral health knowledge, attitudes and behavioural of patients and effectiveness on improving patients' periodontal status-evaluations of a hospital based oral hygiene training program in China. Int J Dent Hyg. 2024.
14. Almståhl A, Palmgren E, Andersson JS. Interprofessional learning and oral health-related attitudes and knowledge among nursing students at a university in Sweden-an exploratory study. Int J Dent Hyg. 2024.
15. Banakar M, Lankarani KB, Vali M, Tabrizi R, Taherifard E, Akbari M. The effect of mass media campaigns on oral health knowledge: a systematic review and meta-analysis. Int J Dent Hyg. 2024; 22(1): 15–23.
16. Şahin T. The effect of individuals' oral hygiene habits and knowledge levels on peri-implant health and disease: a questionnaire-based observational study. BMC Oral Health. 2024; 24(1): 443.
17. Tadin A, Badrov M, Mikelic Vitasovic B, Poklepovic Pericic T. Oral hygiene practices and oral health knowledge among adult orthodontic patients: a best practice implementation project. Hygiene (Basel). 2024; 4(2): 221–30.
18. Bayraktar Nahir C, Coşgun A, Şahin ND, Altan H. Primary school children's oral hygiene knowledge assessed with different educational methods: a cross-sectional study. BMC Oral Health. 2025; 25(1): 148.
19. McKinney DC, Sikdar S, Naavaal S. Improving dental hygiene students' knowledge, attitudes, and confidence toward prenatal oral health through experiential learning: a pilot study. J Dent Hyg. 2025; 99(1): 8–16.
20. Park M-J, Novrinda H, Lee J-Y. Correlation between oral health knowledge, demand for remote education tools, and self-efficacy among parents of children and adolescents. J Korean Soc Dent Hyg. 2025; 25(1): 69–78.