



Original Research

Perception of Dental Caries Risk and Prevention among Orthodontic Patients – A Cross-Sectional Survey

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ABSTRACT

Aim: To investigate the perception of dental caries risk and prevention among patients undergoing orthodontic treatment and to assess the influence of the oral hygiene information attained during orthodontic visits on patient's perception of dental caries prevention.

Methods: A cross-sectional questionnaire gathered information from 207 orthodontic patients (aged 18 and older). The questionnaire included questions about patients' demographics, perception of dental caries risk and prevention during orthodontic treatment, and oral hygiene information received in orthodontic visits. Frequency distributions of responses were evaluated. Chi-square test was used to assess the differences in patients' perception of dental caries prevention by demographics, and the oral hygiene information received during orthodontic appointments.

Results: 74.9% of orthodontic patients perceived to be responsible for dental caries during orthodontic treatment, and 30.4% of patients perceived that it is abnormal to develop dental caries during treatment. Patients receiving information about tooth brushing methods and oral hygiene accessories during orthodontic appointments had a better perception of appropriate oral hygiene in preventing dental caries ($P= 0.01$ and $P= 0.04$, respectively). Moreover, patients receiving dietary information during orthodontic appointments had a better perception of supporting a good diet and avoiding sweets in preventing dental caries ($P< 0.001$ and $P= 0.02$, respectively).

Conclusion: There is a need to improve orthodontic patients' perception of their risk of dental caries during orthodontic treatment and the manners that would help to avoid new decay lesions. Orthodontists should not underestimate the value of providing and reinforcing oral hygiene instructions throughout the course of orthodontic treatment.

Keywords: Oral Hygiene, Dental Decay, Perception, Orthodontics.

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INTRODUCTION

By straightening teeth, enhancing smiles, and optimizing occlusion, orthodontic treatment acts to enhance patients' quality of life and self-esteem. ^[1] Orthodontic treatment indeed has a variety of beneficial effects on patients; however, the presence of orthodontic attachments in the oral cavity influences the distribution of the dental biofilm and makes mechanical plaque removal somewhat difficult. ^[2, 3] Plaque retention around orthodontic fixed appliances complicates the orthodontic treatment experience for patients as well as orthodontists. Plaque accumulation also raises the patient's risk for enamel white spot lesions, dental caries, gingivitis, and possibly periodontitis if accumulated plaque and confined food particles are not removed. ^[4, 5]

To prevent dental health deterioration during orthodontic fixed appliance treatment, it is crucial to maintain good oral hygiene throughout the course of treatment. This can be achieved through regular efficient tooth brushing and interdental cleaning using oral hygiene accessories, together with the use of fluoridated toothpaste and mouthwash. ^[6, 7] Furthermore, orthodontic patients should refrain from sugary food and carbonated soft drinks to reduce their risk of enamel demineralization and white spot lesions. ^[8]

Typically, the orthodontist and orthodontic assistant provide oral hygiene instructions during orthodontic appointments and inform patients about the oral hygiene requirements that must be met during orthodontic treatment. ^[9] This might contribute to the improved oral hygiene behavior observed among many orthodontic patients. ^[10, 11] Nonetheless, supporting preventive oral hygiene measures through long-term treatment necessitates patient compliance. Unfortunately, several studies have demonstrated poor oral hygiene compliance among orthodontic patients ^[12-14] with a rapid drop in patients' compliance after bonding the orthodontic appliance. ^[15] Compliance with therapeutic regimens is shaped by many factors including the relationship between the patient and the provider, the perception of disease susceptibility, the perceived benefits of the treatment, and the complexity and duration of the treatment. ^[16, 17]

There is some uncertainty about how patients perceive their susceptibility to dental caries resulting from insufficient oral hygiene while undergoing orthodontic treatment and how they perceive the benefits of the preventive oral hygiene measures advised by the orthodontist during orthodontic appointments. Thus, this study aims to investigate the perception of dental caries risk and prevention among patients undergoing orthodontic treatment and to assess the influence of the oral hygiene information attained during orthodontic visits on patients' perception of dental caries prevention.

METHODS

The study was granted ethical approval by the Research Ethical Committee of the Faculty of Dentistry at King Abdulaziz University in Jeddah, Saudi Arabia. A cross-sectional questionnaire was devised to assess the perception of dental caries risk and prevention among orthodontic patients, and to evaluate whether the oral hygiene information received during orthodontic visits influences patients' perception of dental caries prevention.

The questionnaire:

Two orthodontists determined the face and content validity of the questionnaire. The clarity of the questionnaire was further gauged by asking two laypeople to evaluate the questions for any ambiguous questions or words. The questionnaire collected information about participants’ demographics including gender, age group, education, and employment. Two statements were used to assess the perception of dental caries risk during orthodontic treatment: “It is normal to have new decay lesions during orthodontic treatment” and “I am responsible for my teeth showing signs of dental decay during orthodontic treatment” Participants’ agreement to these statements was measured on a 3-point Likert scale. The perception of dental caries preventive behaviors among participants was gauged by querying their opinion on manners to avoid dental decay including attending the dentist, appropriate oral hygiene, good diet, and avoiding sweets. To assess the influence of the oral hygiene knowledge attained during orthodontic visits on patients’ perception of dental caries prevention, participants were asked whether they got any information regarding the following oral hygiene care during their orthodontic visits: methods of brushing, diet, oral hygiene accessories, fluoridated toothpaste, and fluoridated mouthwash. The questionnaire is presented in Table 1.

Table 1. Questionnaire

Are you currently undergoing fixed orthodontic treatment?	Yes/ No
Gender:	Male/ Female.
What is your age?	Less than 18/ 18-25 years/ 26-35 years/ 36 and older.
What is the highest level of formal education you have completed?	School student/ High school diploma or equivalent/ Bachelor's degree/ Postgraduate degree.
Your employment status:	Unemployed/ Employed.
What is your opinion about the following statement: “It is normal to have new decay lesions during orthodontic treatment.”	Disagree/ Neutral/ Agree.
What is your opinion about the following statement: “I am responsible for my teeth showing signs of dental decay during orthodontic treatment.”	Disagree/ Neutral/ Agree.
In your opinion, which of those practices is a manner to avoid dental decay? "You can choose more than one answer"	Attending the dentist/ Appropriate oral hygiene/ A good diet/ Avoiding sweets.
What information did you get from orthodontist or dental assistant regarding oral hygiene care during orthodontic appointments? "You can choose more than one answer"	Methods of brushing/ Diet/ Oral hygiene accessories/ Fluoridated toothpaste/ Fluoridated mouthwash.

The participants:

Patients aged 18 and older who were undergoing orthodontic treatment at King Abdulaziz University Dental Hospital were invited to participate in the study. Participants were selected from the list of patients currently undergoing treatment. The questionnaire was sent to the registered phone numbers of the patients with an invitation clearly outlining the aims of the study and informing patients that their participation is voluntary and anonymous. G*Power 3.1.9.2 was utilized to estimate the sample size based on a previous study comparing oral hygiene behavior before and during orthodontic treatment in the same population.^[11] We estimated that a minimal sample size of 197 patients is required to obtain a power of 0.80 at an alpha = 0.05 and effect size = 0.2. Participants' responses were collected between March and July of 2020. To be included in the study, patients must be 18 or older and must indicate that they have started active orthodontic treatment with fixed orthodontic appliances. Responses from patients younger than 18 years and those who did not start active orthodontic treatment were excluded. The questionnaire was sent to 500 patients. A total of 207 patients completed the questionnaire and met the inclusion criteria.

Statistical analysis:

Collected data were inputted into a Microsoft Excel spreadsheet. IBM SPSS Statistics for Macintosh, Version 28.0 (IBM Corp, Armonk, NY) was utilized for statistical analyses. Frequencies and percentages were calculated for patients' demographics and responses to the questionnaire. Pearson Chi-square test was used to evaluate the demographic differences in patients' perception of dental caries prevention, as well as the association between the oral hygiene information received during orthodontic visits and patients' perception of dental caries prevention.

RESULTS

Data analyses included 207 orthodontic patients aged 18 and above. The demographics of participants are presented in Table 2. Females constituted most of the survey respondents (78.3%). The majority of the participants were young adults aged 18-25 years (62.8%). Approximately 62.3% of the participants had a bachelor's degree, 26.1% had a high school diploma or equivalent, and a small number of them had a postgraduate degree or were school students, 7.7% and 3.9% respectively. About 72.5% of the participants were unemployed, while 27.5% were employed in part-time or full-time jobs.

Table 2. Demographics of survey participants (N=207)

Variable	N (%)
<u>Gender</u>	
Male	45 (21.7)
Female	162 (78.3)
<u>Age group</u>	
18-25 years	130 (62.8)
26-35 years	63 (30.4)
36 years and older	14 (6.8)
<u>Education</u>	
School student	8 (3.9)
High school diploma or equivalent	54 (26.1)
Bachelor’s degree	129 (62.3)
Postgraduate degree	16 (7.7)
<u>Employment</u>	
Employed	57 (27.5)
Unemployed	150 (72.5)

Participants’ responses to questions assessing their perception of dental caries risk and responsibility during orthodontic treatment are shown in Table 3. About 30.4% of the participants disagreed that it is normal to develop new decay lesions during orthodontic treatment and 20.3% were neutral. On the other hand, nearly half of the participants agreed that having new carious lesions during orthodontic treatment is normal. When asked if they were responsible for their teeth showing signs of dental decay during the orthodontic treatment, participants mostly agreed that they bear the responsibility for new decay lesions occurring during orthodontic treatment, whereas only 8.2% disagreed with being responsible for new decay lesions and 16.9% were neutral.

Table 3 also summarizes the perception of participants about means to prevent dental caries during orthodontic treatment. A considerable number of participants (84.1%) perceived that adequate oral hygiene is the best way to prevent dental caries during orthodontic treatment. In addition, 53.5% of the participants perceived that attending the dentist is among the ways of dental caries prevention. Nevertheless, a small number of the participants (22.2%) perceived that maintaining a good diet would help to prevent dental caries. Moreover, less than one-quarter of the participants perceived avoiding sweets as a mean to prevent dental caries.

Table 3. Perception of dental caries risk and prevention among survey participants (N=207)

What is your opinion about the following statements?	N (%)
“It is normal to have new decay lesions during orthodontic treatment.”	
Disagree	63 (30.4)
Neutral	42 (20.3)
Agree	102 (49.3)
“I am responsible for my teeth showing signs of dental decay during orthodontic treatment.”	
Disagree	17 (8.2)
Neutral	35 (16.9)
Agree	155 (74.9)
The manners to avoid dental decay is/are: (≥ 1 response per participant)	
Attending the dentist	111 (53.5)
Appropriate oral hygiene	174 (84.1)
A good diet	46 (22.2)
Avoiding sweets	50 (24.2)

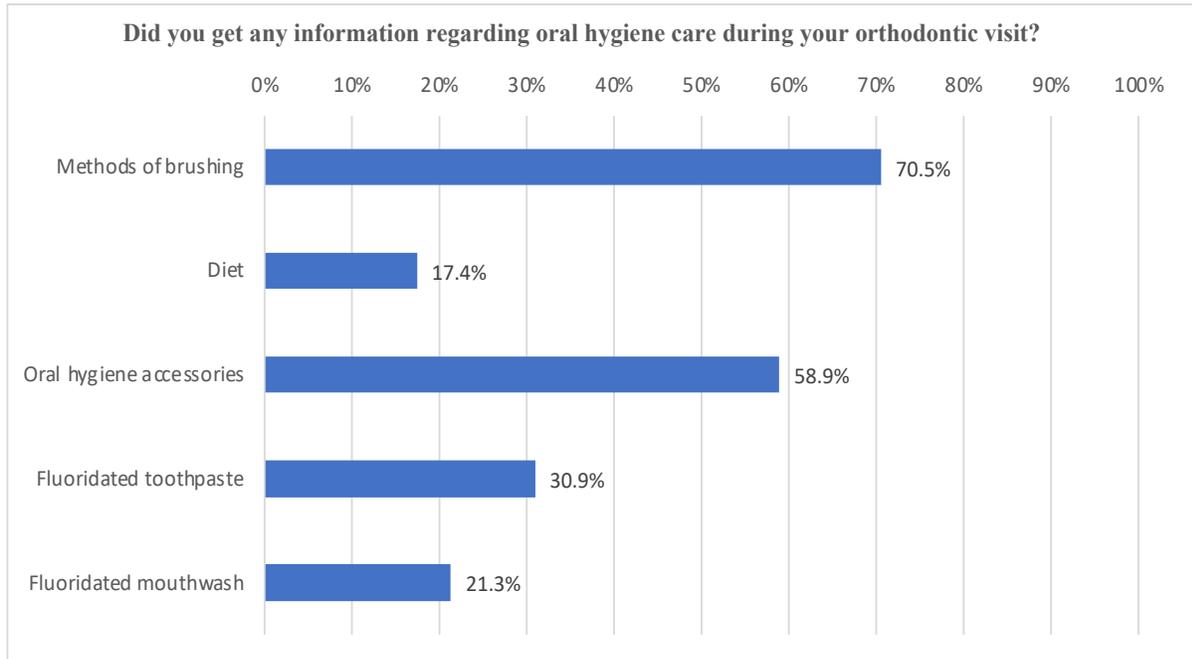
Demographic differences in perception of manners of preventing dental caries are displayed in Table 4. In general, there were no statistically significant differences in the perception of dental caries prevention among participants with different demographic characteristics.

Table 4. Demographic differences in perception of dental caries prevention among participants.

Variable	In your opinion, the manner/s to avoid dental decay is/are:			
	Attending the dentist	appropriate oral hygiene	a good diet	Avoiding sweets
Gender				
Male	51.9%	82.7%	22.8%	24.1%
Female	60.0%	88.9%	20.0%	24.4%
P value	0.33	0.32	0.69	0.69
Age group				
18-25 years	53.8%	85.4%	20.8%	23.1%
26-35 years	50.8%	84.1%	25.4%	27.0%
36 years and older	64.3%	71.4%	21.4%	21.4%
P value	0.66	0.41	0.83	0.81
Education				
School student	75.0%	87.5%	12.5%	37.5%
High school diploma or equivalent	51.9%	88.9%	24.1%	27.8%
Bachelor's degree	51.9%	80.6%	20.2%	20.9%
Postgraduate degree	62.5%	93.8%	37.5%	31.3%
P value	0.54	0.36	0.40	0.51
employment				
Employed	61.4%	86.0%	22.8%	29.8%
Unemployed	50.7%	83.3%	22.0%	22.0%
P value	0.16	0.65	0.90	0.24

The frequency of participants who reported receiving oral hygiene information during orthodontic visits is demonstrated in Figure 1. Approximately 70.5% of the participants reported receiving information about methods of brushing and 58.9% reported receiving information about oral hygiene accessories. A smaller number of participants indicated that they had information about fluoridated toothpaste and fluoridated mouthwash during orthodontic visits, 30.9%, and 21.3% respectively. Furthermore, only 17.4% of participants had information about diet during their orthodontic visits.

Figure 1. Frequency of participants who reported receiving oral hygiene information during orthodontic visits.



The associations between the oral hygiene information received during orthodontic visits and the perception of dental caries prevention among participants are highlighted in Table 5. Overall, participants who reported receiving information about oral hygiene exhibited a better perception of ways of preventing dental caries. About 88.4% of participants who received information about methods of brushing recognized appropriate oral hygiene as a measure to prevent dental decay compared to 73.8% of those who did not receive this information ($P = 0.01$). Participants who received information about methods of brushing were also more likely to perceive that a good diet and avoiding sweets would help in dental caries prevention; however, the associations were not statistically significant. Obtaining information about diet during orthodontic visits was related to a significantly higher perception of the influence of good dietary habits on dental caries prevention. Maintaining a good diet was perceived as a way of preventing dental decay by 50% of those who got dietary instructions, compared to 16.4% among those who did not receive dietary instructions during orthodontic visits ($P < 0.001$). Participants who received dietary instructions were also significantly more likely to perceive avoiding sweets as a method of preventing caries ($P = 0.02$). Moreover, receiving information about oral hygiene accessories was associated with a significantly better perception of appropriate oral hygiene and attending the dentist as methods of avoiding dental caries ($P = 0.04$ and $P = 0.02$ respectively). A significant association was also found between getting information about fluoridated toothpaste and perceiving dental attendance, and avoiding sweets as means to avoid decay. A similar relationship was observed between receiving information about fluoridated mouthwash and attending the dentist, as well as avoiding sweets. Knowledge about fluoridated mouthwash was furthermore significantly related to acknowledging appropriate oral hygiene as a way of preventing dental caries ($P = 0.02$).

Table 5. The association between the oral hygiene information received during orthodontic visits and perception of dental caries prevention among orthodontic patients.

Did you get any information regarding oral hygiene care during your orthodontic visits?	In your opinion, the best manner/s to avoid dental decay is/are:			
	Attending the dentist	appropriate oral hygiene	a good diet	Avoiding sweets
Methods of brushing				
Yes	50.7%	88.4%	22.6%	27.4%
No	60.7%	73.8%	21.3%	16.4%
P value	0.19	0.01	0.84	0.09
Diet				
Yes	63.9%	86.1%	50.0%	38.9%
No	51.5%	83.6%	16.4%	21.1%
P value	0.17	0.71	<0.001	0.02
Oral hygiene accessories				
Yes	60.7%	88.5%	25.4%	27.0%
No	43.5%	77.6%	17.6%	20.0%
P value	0.02	0.04	0.19	0.24
Fluoridated toothpaste				
Yes	65.6%	82.8%	28.1%	34.4%
No	48.3%	84.6%	19.6%	19.6%
P value	0.02	0.74	0.17	0.02
Fluoridated mouthwash				
Yes	68.2%	95.5%	29.5%	38.6%
No	49.7%	81.0%	20.2%	20.2%
P value	0.03	0.02	0.19	0.01

DISCUSSION

Health risk perception can determine individuals' health-related behavior. ^[18] Nearly 1 in every 4 patients develop white spot lesions during orthodontic treatment. ^[19] Hence, it is critical to understand the perception of dental caries risk and prevention among orthodontic patients. The current study aimed to investigate the perception of dental caries risk and prevention among patients undergoing orthodontic treatment and to assess the influence of the oral hygiene information received during orthodontic visits on patients' perception of dental caries prevention. The findings of this study revealed that 74.9% of orthodontic patients perceived being responsible for developing dental caries during orthodontic treatment; however, only 30.4% of patients perceived that it is abnormal to develop dental

caries during orthodontic treatment. Moreover, a considerable number of orthodontic patients did not perceive attending the dentist, supporting a healthy diet, and avoiding sweets as manners to avoid dental caries during orthodontic treatment. Our findings also revealed that patients who obtained oral hygiene information during orthodontic visits had a better perception of preventive oral health behaviors.

The notion of personal control over health can favorably influence individuals' health status.^[20] In the current study, almost three-fourths of the patients perceived to be responsible for new carious lesions during orthodontic treatment. A higher percentage was reported by Martignon et al. in 2010, with 81% of young patients receiving fixed orthodontic treatment agreeing to being responsible for new signs of dental caries during treatment.^[21] Findings from Maxfield et al also showed that most orthodontic patients indicated being responsible for the prevention of the occurrence of white spot lesions.^[22]

Perceiving proneness to oral diseases could deter individuals from implementing oral disease preventive measures.^[23] Therefore, perceiving that having new dental carious lesions is normal could negatively influence the uptake of preventive oral health behaviors. In the present study, almost half of the participating orthodontic patients perceived that it is normal to develop new carious lesions during treatment, while 30.4% were aware that such an occurrence is not normal. In the study by Martignon et al. 58% of orthodontic patients perceived having dental caries during orthodontic treatment as abnormal.^[21]

The present study revealed that a significant proportion of participants (84.1%) perceived that maintaining proper oral hygiene is an effective method to avoid dental caries while undergoing orthodontic treatment. Similarly, Maxfield et al. described that most patients believed that inadequate brushing and flossing would lead to the development of white spot lesions during orthodontic treatment.^[22] In their study among orthodontic patients in Nigeria, Ajayi and Azodo also showed that 89.1% of orthodontic patients recognized that tooth brushing could prevent dental caries and periodontal diseases.^[24] However, in the Martignon et al study less than half of the patients undergoing fixed orthodontic treatment perceived that appropriate oral hygiene is the best way to prevent dental caries.^[21] Furthermore, orthodontic patients in the Martignon et al study^[21] exhibited a considerably lower perception regarding attending dental visits, maintaining a good diet, and avoiding sweets compared to orthodontic patients in the current study. Yet, fewer than 25% of the participating patients in this study believed that adhering to a healthy diet and abstaining from sweets would be effective in preventing dental caries. Previous studies indicated frequent sugar consumption among orthodontic patients although the consumption of sticky food has been reported to be reduced among patients undergoing active orthodontic treatment.^[11, 25] It appears that the alteration in diet observed among many orthodontic patients is mainly due to the inconveniences related to the presence of the fixed orthodontic appliance rather than the awareness that supporting a healthy diet and avoiding sweets are important factors in preventing dental caries.^[26]

Normally, patients receive oral hygiene instructions the day the orthodontic appliance is bonded, and thereafter, oral hygiene is reinforced during orthodontic follow-up appointments. Most patients in this study (70.5%) reported receiving information about methods of tooth brushing, and almost 60% reported receiving information on oral hygiene accessories; however, a relatively small percentage of participating patients in this study obtained information about the use of fluoridated toothpaste and mouthwash; moreover, receiving information about diet was reported only by 17.4% of patients in this study.

In alignment with our findings, Mahjoub et al. found that orthodontic patients who obtained oral hygiene information had significantly better awareness levels about oral hygiene.^[27] A noteworthy finding in this study is the relation between the nature of the information received during orthodontic visits and the type of oral hygiene measures that the patients perceived as methods to prevent dental caries. Patients who reported receiving information about brushing methods, patients who received information about oral hygiene accessories, and those who received information about fluoridated mouthwash were significantly more likely to perceive performing appropriate oral hygiene as a manner to avoid dental caries. Furthermore, orthodontic patients who reported receiving information about diet were significantly more likely to recognize that maintaining a good diet and avoiding sweets are manners to avoid dental caries. These days smartphone applications can be utilized as patients' reminders, reinforcing oral hygiene among orthodontic patients.^[28, 29]

This study has some limitations. The findings of this study may not be generalized to other populations. In addition, patients' responses to whether they have received oral hygiene information during orthodontic visits are subjected to recall bias. Furthermore, data were collected cross-sectionally and thus, it is not possible to make causal inferences between the information obtained during orthodontic visits and patients' perception of caries prevention. Regardless of these limitations, the current study adds to our understanding of how orthodontic patients perceive their risk of dental caries, and how they perceive the benefits of various oral hygiene measures in preventing dental caries. This study also supports previous evidence about the importance of the oral hygiene information that patients obtain during orthodontic follow-up appointments in enhancing patients' perception of dental caries prevention measures.

CONCLUSION

The findings of this study indicate that there is a need to improve patients' perception of their risk of dental caries during orthodontic treatment as well as their perception of the manners that would help them avoid new decay lesions. The findings of this study also confirm that the oral hygiene information received during orthodontic visits has a positive influence on the perception of preventive oral health behaviors among orthodontic patients. Orthodontists should not underestimate the value of providing oral hygiene instructions and reinforcing patients' oral hygiene practices throughout the course of orthodontic treatment.

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CONFLICT OF INTEREST

The authors have no conflict of interest to declare.

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