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Factors Affecting Dental Health Behaviors in Patients Using Removable Partial Dentures

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ABSTRACT

OBJECTIVE: To study the dental health behaviors and factors affecting the dental health behaviors of patients using removable partial dentures (RPDs).

METHODS: A cross-sectional descriptive study was conducted with 650 patients that wore RPDs and visited the dental department at Vajira Hospital, Thailand from July 2021 to October 2022. Data were collected using a structural questionnaire which consisted of four parts: demographic information, health status, dental health, and dental health behaviors. Data were analyzed using descriptive statistics and multiple logistic regression analysis at a significance level of 0.05.

RESULTS: Most of the patients brushed their teeth twice a day (72.2%) and used dental care tools (67.5%) such as mouthwash, dental floss, and proxabrush. Regarding denture care, most of the patients cleaned their dentures twice a day (51.2%), brushed with toothpaste (69.4%), and soaked their dentures in water at night (80.5%). Half of the patients visited dentists only when they had dental problems (52.5%). No statistically significant difference between the study variables and the frequency of brushing teeth or the methods of cleaning dentures was found. The application of dental care tools was significantly related to gender and the number of remaining teeth ($p < 0.001$). Further, the frequency of denture brushing was significantly associated with gender and educational level. The behavior of storing dentures appropriately at night was significantly associated with marital status, occupation, the position of dentures ($p < 0.001$), and their experience with wearing dentures. Additionally, the frequency of dental visits differed significantly depending on educational level, income per month, health insurance, the frequency of medical visits, the number of systemic diseases, and the number of remaining teeth.

CONCLUSION: Most of the patients wearing RPDs that attended Vajira Hospital did not follow dental care guidelines and irregularly visited the dentist. The demographic information, health status, and dental health had a correlation with dental health behaviors.

KEYWORDS: dental health behavior, dental health care, removable partial denture

INTRODUCTION

According to the 8th National Oral Health Survey of Thailand, tooth loss was the most common oral health problem among adults and seniors[1]. The average tooth loss for adults of ages ranging from 35 to 44 years was 3.6 teeth per person. The older persons aged 60-74 and 80-85 years had averagely 18.6 and 10 remaining teeth, respectively. This small number of remaining teeth affected masticatory efficiency. Therefore, dentures were frequently used to improve occlusion, pronunciation, and appearance, which also affected the physical and mental health as well as the quality of life of the edentulous persons[2-3]. According to the national oral health survey, only 5.2% of adults wore dentures, but 72.3% needed to wear removable partial dentures (RPDs).

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Most partially edentate patients prefer receiving RPD treatment because it is simple and more cost-effective than with fixed dental prosthesis. However, the post-insertion problems with RPDs are discomfort, denture pain, food impaction under the denture base, dental caries, and periodontitis[4-5]. Since RPDs require clasps that attach to the abutments in order to keep dentures stable when chewing, the area under the clasp and the rough acrylic surface of the dentures become areas for plaque accumulation, resulting in dental caries and periodontitis[6]. Previous studies have found that wearing RPDs resulted in increased risk of dental caries[5,7], and also gingivitis and periodontitis, particularly on the abutment teeth[8]. Therefore, in order to prevent dental problems, such as dental caries and tooth loss, denture wearers should have proper dental health behaviors and regularly dental check-ups[9-10].

Proper dental health behaviors and denture care practices are crucial and are key factors for good dental health in order to prevent tooth loss[11]. The suggested practices for good dental health and denture care are brushing teeth and dentures after every meal, brushing dentures with soap or denture cleaning solution, always removing dentures at night, and storing dentures in a container with water. However, many studies have found that denture wearers did not follow these practices[12-14]. In addition, a regular dental check-up every six months or at least annually is important for detecting early dental problems and for preventing severe dental diseases. Previous studies have analyzed the factors influencing patients' dental visits, such as sex[15-17], age[15-16], number of remaining teeth[15], and systemic disease[18]. However, a lack of studies regarding dental health behaviors has been conducted on denture wearers in Thai population.

Therefore, the objectives of this study were to examine the dental health behaviors and to evaluate the association between the factors and the dental health behaviors among patients wearing RPDs that received dental service in the dental department at Vajira Hospital, Bangkok, Thailand. The hypothesis was that several factors, including demographic information, health status, and dental health, affected the dental health behaviors.

METHODS

This cross-sectional descriptive study was conducted among patients wearing RPDs that visited the dental department at Vajira Hospital in Thailand from July 2021 to October 2022. Before conducting the study, the research was approved by the Ethical Committee of Navamindradhiraj University (COA 093/2564). The sample size was calculated using the following formula[19]:

$$n_1 = \left[\frac{z_{1-\frac{\alpha}{2}} \sqrt{\bar{p}\bar{q}\left(1+\frac{1}{r}\right)} + z_{1-\beta} \sqrt{p_1 q_1 + \frac{p_2 q_2}{r}}}{\Delta} \right]$$

$$r = \frac{n_2}{n_1}, q_1 = 1 - p_1, q_2 = 1 - p_2$$

$$\bar{p} = \frac{p_1 + p_2 r}{1+r}, \bar{q} = 1 - \bar{p}$$

In this formula, the symbol "n_1" represented the sample size for group 1. The symbol "p_1" and "p_2" were the proportion of outcomes occurring in group 1 and group 2, respectively. The symbol "r" was the ratio between the sample size in group 2 and group 1. The data from the study of Szalewski et al.[20] were represented in the formula. The significance level and the power level were set at 5% and 80%, respectively. According to this formula, the result of the sample size was 613 persons and consisted of at least 196 and 417 men and women, respectively. The dropout rate was set at 5%, so the total sample size was 650 persons. The patients that met the inclusion criteria and that did not meet any exclusion criteria were included in the study. The inclusion criteria were as follows: a patient aged over 18 years that is wearing RPDs or is wearing a RPD with an upper or lower full denture and that is receiving dental services in the dental department at Vajira Hospital; and a patient that has full consciousness, can communicate well in the Thai language, that has no hearing problems, and a patient that consents to and cooperates in answering the questionnaire. The exclusion criteria were as follows: a patient that has no remaining teeth; a patient that is wearing an immediate RPD; and a patient that has dementia and cannot cooperate in answering the questionnaire.

Before participating in the study, the patients were informed about the objectives of the study and were asked for consent. The questionnaire used in the study was designed and developed by reviewing many previous studies[12,15,20]. The questionnaire consists of four parts: demographic information (gender, age, marital status, address, educational level, occupation, and monthly income); health status (health insurance, frequency of medical visits, number of systemic diseases, physical capability, smoking, and drinking); dental health (number of remaining teeth, position of dentures, experience with wearing dentures, and having denture problems); and dental health behaviors (frequency of brushing teeth, using dental care tools, frequency of cleaning dentures, method of cleaning dentures, storing dentures at night, and frequency of dental visits). The content validity of each question in the questionnaire was evaluated by three specialists using the index of item objective congruence (IOC) developed by Rovinelli and Hambleton[21]. The IOC for each question was in the range between 0.67 and 1.00.

Data analysis was carried out using descriptive statistics and multiple logistic regression analysis. Descriptive statistics were used to analyze the frequency and percentages of the categorical data, and multiple logistic regression analysis was performed in order to analyze the factors associated with dental health behaviors. For the multiple logistic regression analysis, each dental health behavior was classified into binary outcomes by using Vajira's denture care guidelines (table 1). The cut-off point for the frequency of brushing teeth and dentures in this study was three times per day because we assumed that everyone had three meals a day. The significant factors ($p < 0.20$) in the univariate analysis were subjected to multivariate analysis in order to determine the independent predictive factors. The data were analyzed using IBM SPSS Statistics for Windows, Version 28.0 (IBM SPSS Statistics for Windows, Version 28.0. Armonk, NY, USA: IBM Corp.). The statistical significance was set at 0.05.

RESULTS

A total of 650 patients, consisting of 196 males and 454 females aged 21 to 98 years, participated in this study. The majority of the patients belonged to the age group of 60 to 80 years. Most were married, lived in Bangkok, had a bachelor's degree, were unemployed or retired, and had an income lower than 10,000 baht/month. Most of the patients had government or state enterprise officers' medical benefits, visited physicians at least once a year, and had one systemic disease. Moreover, they were independent, non-smoking, and non-drinking. Most of the patients had 10 to 19 remaining teeth, wore upper and lower dentures, had been wearing dentures for more than 10 years, and did not have denture problems. The descriptive statistics on the demographic information, health status, and dental health are presented in Table 2.

Table 1 Classification of dental health behaviors by using Vajira's denture care guidelines

Dental health behaviors	Binary outcome	
	Following Vajira's guidelines	Not following Vajira's guidelines
Frequency of brushing teeth	3 times/day, more than 3 times/day	None 1 time/day 2 times/day
Using dental care tools	Yes	No
Frequency of brushing dentures	3 times/day, more than 3 times/day	1 time/day 2 times/day
Methods of cleaning dentures	Brushing with soap Using denture cleaning solution	Rinsing or brushing with water Brushing with toothpaste
Storing dentures at night	Storing dentures in water	Wearing dentures while sleeping Storing dentures in a dry container
Frequency of dental visits	Every 6 months Once a year	More than 1 year When having dental problems

Table 2 Demographic information, health status, and dental health

Variable type	Study variables	Factors	Frequency (%)
Demographic information	Gender	Male	196 (30.2)
		Female	454 (69.8)
	Age group	Less than 60 years old	158 (24.3)
		60-80 years old	421 (64.8)
		More than 80 years old	71 (10.9)
	Marital status	Married	343 (52.8)
		Never married	151 (23.2)
		Divorced/Widowed/Separated	156 (24.0)
	Address	Bangkok	492 (75.7)
		Suburb (e.g. Nonthaburi, Suphanburi)	158 (24.3)
	Educational level	Never attended school/Elementary school	142 (21.8)
		High school	130 (20.0)
		Diploma	72 (11.1)
		Bachelor's degree	232 (35.7)
		Postgraduate	74 (11.4)
	Occupation	Unemployment/Retirement	430 (66.2)
		Government employee	90 (13.8)
		Merchant/Personal business	77 (11.8)
		Other	53 (8.2)
	Income (per month)	Less than 10,000 baht	231 (35.5)
		10,000-19,999 baht	112 (17.2)
		20,000-29,999 baht	131 (20.2)
		30,000-39,999 baht	88 (13.5)
		40,000 baht or more	88 (13.5)
Health status	Health insurance	Government or state enterprise officers' medical benefits	384 (59.1)
		Universal health coverage	153 (23.5)
		Social security scheme	65 (10.0)
		None	48 (7.4)
	Frequency of medical visits	Having medical problem/more than 1 year	157 (24.2)
		At least once a year	493 (75.8)
	Number of systemic diseases	None	126 (19.4)
		1 disease	203 (31.2)
		2 diseases	161 (24.8)
		More than 2 diseases	160 (24.6)
	Physical capability	Independence	610 (93.8)
		dependence	40 (6.2)
	Smoking	No	625 (96.2)
		Yes	25 (3.8)
	Drinking	No	615 (94.6)
		Yes	35 (5.4)
Dental health	Number of remaining teeth	1-9 teeth	152 (23.4)
		10-19 teeth	262 (40.3)
		20 teeth or more	236 (36.3)
	Position of dentures	Upper	212 (32.6)
		Lower	123 (18.9)
		Upper and lower	315 (48.5)
	Experience with wearing dentures	1-5 years	194 (29.8)
		6-10 years	168 (25.8)
		More than 10 years	288 (44.3)
	Having denture problems	No	366 (56.3)
		Yes	284 (43.7)

Most of the patients brushed their teeth twice a day and used dental care tools such as mouthwash, dental floss, and proxabrush. Regarding denture care, the patients mostly brushed their dentures twice a day, brushed with toothpaste, and stored their dentures in water at night. Furthermore, they visited dentists only when having dental problems. The descriptive statistics on their dental health are presented in Table 3.

The results of the associations between the study variables and dental health behaviors using multiple logistic regression analysis are shown in Table 4. No statistically significant difference was found between the study variables and the frequency of the patients brushing their teeth or the methods of cleaning their dentures. The application of dental care tools was significantly higher among the females and the patients that had more than 20 teeth. The frequency of the patients cleaning their dentures three times or more per day was significantly associated with females and those that had attended high school. The association of inappropriate denture storage at night with the patients that were divorced, widowed or separated, merchants or those that had a personal business, the patients that wore only upper dentures, and the patients that wore dentures six years or more was statistically significant. Regular dental check-ups were significantly associated with a bachelor's degree, earning 20,000 baht per month or more, having no health insurance, visiting physicians at least once a year, and having 20 teeth or more. Furthermore, those having more than two systemic diseases significantly tended to visit the dentist more than one year or when having medical problems more than those having no systemic disease. A summary of the associations between the study variables and dental health behaviors is shown in Table 5.

Table 3 Dental health behaviors

Behaviors	Factors	Frequency (%)
Frequency of brushing teeth	None	1 (0.2)
	1 time/day	20 (3.1)
	2 times/day	469 (72.2)
	3 times/day	133 (20.5)
	More than 3 times/day	27 (4.2)
Using dental care tools	No	211 (32.5)
	Yes	439 (67.5)
	Mouthwash	249 (38.3)
	Dental floss	237 (36.5)
	Proxabrush	140 (21.5)
	Other	6 (0.9)
Frequency of brushing dentures	1 time/day	100 (15.4)
	2 times/day	333 (51.2)
	3 times/day	148 (22.8)
	More than 3 times/day	69 (10.6)
Methods of cleaning dentures	Rinsing with water	33 (5.1)
	Brushing with water	73 (11.2)
	Brushing with toothpaste	451 (69.4)
	Brushing with soap	39 (6.0)
	Using denture cleaning solution	131 (20.2)
	Other	3 (0.5)
Storing dentures at night	Wearing dentures while sleeping	81 (12.5)
	Storing dentures in a dry container	46 (7.1)
	Storing dentures in water	523 (80.5)
Frequency of dental visits	Every 6 months	140 (21.5)
	Once a year	125 (19.2)
	More than 1 year	44 (6.8)
	When having dental problems	341 (52.5)

Table 4 Showing the associations between the study variables and dental health behaviors

Study variables	Using dental care tools			Frequency of brushing dentures			Storing dentures at night			Frequency of dental visits		
	Crude OR	Adjusted OR (95%CI)	P-value	Crude OR	Adjusted OR (95%CI)	P-value	Crude OR	Adjusted OR (95%CI)	P-value	Crude OR	Adjusted OR (95%CI)	P-value
Gender												
Male	1.00	1.00 (Reference)		1.00	1.00 (Reference)		1.00			1.00		
Female	1.70	1.73 (1.13-2.66)	0.013	1.53	1.50 (1.01-2.22)	0.042	1.29			0.97		
Age group												
Less than 60 years old	1.00	1.00 (Reference)		1.00			1.00	1.00 (Reference)		1.00	1.00 (Reference)	
60-80 years old	1.07	1.25 (0.71-2.21)	0.435	1.00			1.39	0.78 (0.42-1.45)	0.433	0.81	0.84 (0.48-1.48)	0.554
More than 80 years old	0.50	0.93 (0.42-2.07)	0.854	0.70			1.73	0.96 (0.38-2.39)	0.923	0.33	0.57 (0.24-1.36)	0.202
Marital status												
Married	1.00	1.00 (Reference)		1.00			1.00	1.00 (Reference)		1.00	1.00 (Reference)	
Never married	1.07	0.86 (0.53-1.39)	0.538	1.27			0.87	0.80 (0.48-1.33)	0.379	1.12	1.06 (0.67-1.68)	0.796
Divorced/Widowed/ Separated	0.75	0.87 (0.54-1.37)	0.538	1.07			0.72	0.52 (0.32-0.87)	0.012	0.61	0.95 (0.59-1.52)	0.824
Address												
Bangkok	1.00			1.00			1.00			1.00		
Suburb	1.28			0.83			1.17			0.99		
Educational level												
Never attended school/ Elementary school	1.00	1.00 (Reference)		1.00	1.00 (Reference)		1.00			1.00	1.00 (Reference)	
High school	1.31	1.04 (0.61-1.77)	0.901	1.66	1.76 (1.01-3.05)	0.045	0.90			1.80	1.31 (0.70-2.42)	0.398
Diploma	2.96	1.95 (0.94-4.05)	0.072	1.09	1.03 (0.51-2.07)	0.937	1.36			2.20	1.24 (0.60-2.59)	0.563
Bachelor's degree	2.17	1.26 (0.71-2.25)	0.426	1.52	1.36 (0.76-2.43)	0.302	1.08			4.71	2.21 (1.19-4.10)	0.012
Postgraduate	3.62	1.97 (0.87-4.47)	0.105	2.05	1.75 (0.84-3.64)	0.136	0.82			5.11	2.09 (0.95-4.59)	0.066
Occupation												
Unemployment/ Retirement	1.00	1.00 (Reference)		1.00			1.00	1.00 (Reference)		1.00	1.00 (Reference)	
Government employee	1.29	1.03 (0.48-2.19)	0.947	0.88			0.56	0.51 (0.25-1.06)	0.071	1.81	0.98 (0.48-1.99)	0.948
Merchant/ Personal business	0.82	0.92 (0.50-1.67)	0.777	1.05			0.55	0.41 (0.22-0.78)	0.007	0.69	0.63 (0.34-1.17)	0.141
Other	0.66	0.86 (0.43-1.72)	0.660	0.84			1.00	0.90 (0.39-2.08)	0.806	0.99	0.99 (0.48-2.02)	0.974
Income (per month)												
Less than 10,000 baht	1.00	1.00 (Reference)		1.00	1.00 (Reference)		1.00			1.00	1.00 (Reference)	
10,000-19,999 baht	1.56	1.38 (0.81-2.37)	0.236	1.09	1.09 (0.64-1.84)	0.753	0.89			1.27	0.94 (0.53-1.68)	0.832
20,000-29,999 baht	2.02	1.66 (0.94-2.93)	0.083	1.39	1.35 (0.79-2.32)	0.276	1.20			2.92	2.03 (1.15-3.57)	0.014
30,000-39,999 baht	2.51	1.53 (0.74-3.15)	0.250	1.74	1.48 (0.78-2.82)	0.229	0.78			3.67	2.10 (1.05-4.21)	0.036
40,000 baht or more	2.21	1.39 (0.66-2.93)	0.384	1.18	1.07 (0.55-2.10)	0.845	0.78			4.03	2.16 (1.05-4.45)	0.036
Health insurance												
Government or state enterprise officers' medical benefits	1.00	1.00 (Reference)		1.00	1.00 (Reference)		1.00			1.00	1.00 (Reference)	
Universal health coverage	0.54	0.82 (0.49-1.35)	0.425	0.80	0.97 (0.60-1.56)	0.896	0.85			0.39	0.94 (0.54-1.64)	0.830
Social security scheme	0.63	0.70 (0.37-1.34)	0.279	0.59	0.61 (0.32-1.17)	0.139	1.29			0.83	1.09 (0.57-2.12)	0.790
None	1.19	1.53 (0.71-3.29)	0.278	0.99	1.18 (0.61-2.31)	0.623	0.79			1.08	2.52 (1.20-5.26)	0.014

Table 4 Showing the associations between the study variables and dental health behaviors (continued)

Study variables	Using dental care tools			Frequency of brushing dentures			Storing dentures at night			Frequency of dental visits		
	Crude OR	Adjusted OR (95%CI)	P-value	Crude OR	Adjusted OR (95%CI)	P-value	Crude OR	Adjusted OR (95%CI)	P-value	Crude OR	Adjusted OR (95%CI)	P-value
Frequency of medical visits												
Having medical problem/ more than 1 year	1.00			1.00			1.00			1.00	1.00 (Reference)	
At least once a year	1.08			0.73			1.25			2.92	4.88 (2.93-8.13)	< 0.001
Number of systemic diseases												
None	1.00			1.00	1.00 (Reference)		1.00	1.00 (Reference)		1.00	1.00 (Reference)	
1 disease	1.04			0.58	0.65 (0.40-1.07)	0.092	1.29	1.19 (0.68-2.08)	0.543	1.02	0.70 (0.40-1.21)	0.199
2 diseases	0.94			0.68	0.77 (0.45-1.33)	0.353	1.78	1.81 (0.96-3.43)	0.068	0.89	0.63 (0.34-1.15)	0.131
More than 2 diseases	0.77			0.64	0.77 (0.44-1.33)	0.344	1.41	1.32 (0.71-2.46)	0.387	0.59	0.42 (0.22-0.79)	0.007
Physical capability												
Independence	1.00	1.00 (Reference)		1.00			1.00			1.00	1.00 (Reference)	
dependence	0.37	0.58 (0.27-1.24)	0.162	0.65			0.97			0.15	0.37 (0.11-1.17)	0.090
Smoking												
No	1.00			1.00			1.00			1.00	1.00 (Reference)	
Yes	0.60			0.62			0.76			0.55	0.43 (0.16-1.14)	0.090
Drinking												
No	1.00	1.00 (Reference)		1.00			1.00			1.00		
Yes	0.49	0.55 (0.26-1.16)	0.117	1.04			1.49			0.75		
Number of remaining teeth												
1-9 teeth	1.00	1.00 (Reference)		1.00	1.00 (Reference)		1.00			1.00	1.00 (Reference)	
10-19 teeth	2.03	1.66 (1.06-2.58)	0.027	1.35	1.23 (0.78-1.95)	0.371	1.00			1.49	1.20 (0.73-1.98)	0.474
20 teeth or more	3.53	2.38 (1.42-3.98)	< 0.001	1.38	1.13 (0.70-1.85)	0.616	0.92			3.38	1.97 (1.16-3.35)	0.012
Position of dentures												
Upper	1.00	1.00 (Reference)		1.00			1.00	1.00 (Reference)		1.00	1.00 (Reference)	
Lower	1.64	1.47 (0.85-2.55)	0.171	0.86			1.44	1.47 (0.85-2.55)	0.170	1.59	1.13 (0.67-1.92)	0.642
Upper and lower	0.85	0.98 (0.65-1.49)	0.933	0.85			2.51	2.67 (1.66-4.28)	< 0.001	0.84	1.01 (0.66-1.54)	0.970
Experience with wearing dentures												
1-5 years	1.00	1.00 (Reference)		1.00	1.00 (Reference)		1.00	1.00 (Reference)		1.00		
6-10 years	1.19	1.24 (0.76-2.02)	0.392	1.17	1.14 (0.71-1.82)	0.585	0.70	0.48 (0.27-0.85)	0.012	0.87		
More than 10 years	1.38	1.35 (0.87-2.10)	0.177	1.46	1.39 (0.92-2.10)	0.124	0.72	0.51 (0.30-0.86)	0.012	0.82		
Having denture problems												
No	1.00			1.00			1.00	1.00 (Reference)		1.00		
Yes	1.07			0.83			1.35	1.37 (0.91-2.08)	0.134	0.82		

Abbreviations: CI, confident interval; OR, Odds Ratio

Variable was included in the multivariable model due to having a p-value < 0.200 in the univariable analysis.

Table 5 The summary of the associations between dental health behaviors and study variables

Dental health behaviors	Study variables
Frequency of brushing teeth	-
Using dental care tools	Gender Number of remaining teeth
Frequency of brushing dentures	Gender Educational level
Methods of cleaning dentures	-
Storing dentures at night	Marital status Occupation Position of dentures Experience with wearing dentures
Frequency of dental visits	Educational level Income per month Health insurance Frequency of medical visits Number of systemic diseases Number of remaining teeth

DISCUSSION

Denture care guidelines vary among countries. In this study, each dental health behavior was classified into binary outcomes according to the denture care guidelines at Vajira Hospital. These guidelines suggest brushing teeth and cleaning dentures after each meal, using dental care tools, cleaning dentures with soap or denture cleaning solution, removing dentures at night and storing them in water, and visiting the dentist one to two times per year. The results of this study revealed that no study variables affected the frequency of brushing teeth or the methods of cleaning dentures, but statistically significant differences between the study variables and the other dental health behaviors were found. Therefore, the null hypothesis was rejected.

In a cross-sectional study, an adequate sample size is needed in order to estimate the population prevalence. We used the data from the study of Szalewski et al.[20] to estimate the sample size because we found that representing the formula with the proportion of males and females that did not visit the dentist yielded a maximum sample size. So, we used the gender factor in order to calculate the sample size in our study. Moreover, the ratio between males and females in previous study was 0.47, and this might be the reason that the number of females in this study was twice that of the males.

Most of the patients brushed their teeth two times a day. Only a quarter of the patients followed Vajira's guidelines. There was no statistically significant association between the study variables and the frequency of brushing teeth. This result differed from previous studies[16,22]. For example, Olusile et al.[16] found that age, gender, marital status, educational level, and occupation were significantly related to the frequency of brushing teeth. Moreover, Kim et al.[22] found that patients with higher income and educational level were more likely to brush their teeth more than three times per day.

Using dental care tools is recommended for denture wearers because wearing RPDs increases plaque formation and poses higher risks of dental diseases. Therefore, denture wearers should pay special attention to cleaning their teeth. In this study, the percentage of patients that used dental care tools was higher than in other previous studies. According to the 8th National Oral Health Survey of Thailand, about half of the elderly (60-74 years old) used dental care tools[1]. The dental care tools that were mostly used were toothpicks (28.6%) and mouthwash (20.3%). Only 6% of the elderly used dental floss or proxabrush. A study of adult Nigerians reported that only 10.5% of the participants used dental floss or other dental care tools[16]. Moreover, Cakan et al.[13] discovered that only 4.8% of RPD wearers in a university hospital

used dental floss. This study also found a significant relationship between using dental care tools and gender and the number of remaining teeth. This finding is similar to Wang et al.'s study[23], which indicated that using extra dental care tools such as dental floss and mouthwash was associated with having more remaining teeth. However, we did not find an association between using dental care tools and income or educational level, which is not in line with Kim et al.'s study results[22].

Half of the patients in the present study cleaned their dentures two times a day. According to the interviews with the patients, they usually cleaned their dentures while brushing their teeth. Nevertheless, Barreiro et al.[24] found that 74.9% of denture wearers cleaned their dentures three times or more a day, whereas Cakan et al.[13] and Saha et al.[25] found that more than half of the denture wearers cleaned their dentures only once a day. The association between the frequency of brushing dentures and gender was significantly found in this study. This confirmed the finding of previous studies[12,13,26]. Further, we discovered a relationship between the frequency of brushing dentures and educational level, but not with smoking. These findings were opposite those of Cakan et al.'s study[13].

Cleaning dentures with a denture cleaning solution, toothpaste, or soap is commonly recommended by dentists[27]. However, the available toothpaste in Thailand contains ingredients that could abrade and scratch the surface of dentures[28-29]. The surface roughness of dentures results in increasing biofilm accumulation, microbial colonization, and discomfort of wearers[29]. Therefore, Vajira's denture care guidelines recommend using a denture cleaning solution or soap to clean dentures instead of toothpaste. In this study, most of the patients used toothpaste to clean their dentures, which could imply that most of the patients did not have correct knowledge about how to clean their dentures. Furthermore, we found that three patients used dishwashing liquid to clean their dentures. From the study of Sudswad et al.[29], dishwashing liquid could be used to clean dentures in the same way as using soap; however, dishwashing liquid is not widely recommended by dentists[27]. The study of Shankar et al.[26] on complete denture wearers found a correlation between denture cleaning method and gender. However, no statistical significance was found between the study variables and the methods that the patients used to clean their dentures in our study.

About 80% of the patients followed the dental recommendation of storing their dentures in water at night. However, 12.5% of the patients wore their dentures while sleeping, and 7.1% of the patients kept their dentures in dry containers. The percentage of the patients wearing dentures overnight was lower than in previous studies[13-14,24]. In this study, appropriate denture storage at night differed significantly depending on marital status, occupation, the position of dentures, and the patient's experience with wearing dentures. There was no significant difference between appropriate denture storage at night and age or educational level, which is similar to Cakan et al.'s study[13]. On the other hand, Szalewski et al.[20] found that educational level statistically significantly affected the practice of wearing dentures overnight. Moreover, Cakan et al.[13] also found that the removal of dentures at night was significantly lower among the participants that used their second dentures or more. This is in accordance with our study's results that the patients that had worn dentures for more than five years tended to store them at night incorrectly. The esthetic concern, lacking knowledge, and individual experience could be a reason why the patients wore their dentures or kept them in dry containers at night; so, dentists should inform the patients about proper storage denture at night because wearing dentures at night increases the risk of fungal infection and denture stomatitis[30].

More than half of the patients visited dentists only when having dental problems. This finding was similar to that of previous studies[20,24,31].

For example, Barreiro et al.[24] revealed that most of the participants visited dentists only when there was a complaint, and Namrata et al.[31] and Szalewski et al.[20] found that only 10% and 3.7% of the patients went for regular check-ups. No significant difference between gender and the frequency of dental visits was found in this study or in other studies[16-17]. This result differed from Szalewski et al.'s study[20]. The result in the present study that income and educational level significantly affected the frequency of dental visits supported Kim et al.'s study[22]. Further, Olusile et al. [16] found that patients with a higher educational level reported significantly more utilization of dental health services. This study also confirmed the association between the frequency of visiting physicians and visiting dentists; the patients that visited physicians at least once a year were more likely to visit dentists regularly. Surprisingly, the patients without health insurance tended to have regular dental visits. This result was in contrast to the study of Lutfiyya et al.[15]. Moreover, the patients that had more than two systemic diseases tended to have fewer dental check-ups. Therefore, a system should be created for determining if individuals have many systemic diseases because they have higher risks for loss of follow-ups. The patients that had lost more teeth also had a significantly higher chance of visiting the dentist only when having dental problems. This might reflect patients' unawareness of their oral health care.

Many researches have studied dental health behaviors and the factors that affect dental health behaviors in patients using RPDs[12-13,20,24,31]. The results of the researches were heterogenous. This could be due to demographic differences and the varied denture care guidelines and dentists' recommendation among countries[27,32]. This study was conducted with patients wearing RPDs in only one dental hospital setting in Thailand, so the generalizability of the findings may be limited to partially edentulous people living in urban areas of Thailand. Furthermore, since the grouping of each dental health behavior was classified using dental guidelines in Thailand, the results of this study might differ from those of other countries where dental guidelines are different. In future studies, dental diseases such as dental caries, periodontitis, and oral candidiasis should be assessed in denture wearers. In addition, the association among dental diseases and dental health behaviors should be investigated.

CONCLUSION

Most of the patients wearing RPDs at Vajira Hospital did not follow the denture care guidelines and irregularly visited the dentist. Dentists should be reminded to advise and motivate patients to realize the importance of regular dental visits and of expected dental behaviors. Further, appointments for dental check-ups should be regularly scheduled. In addition, gender, educational level, marital status, occupation, income per month, health insurance, the frequency of medical visits, the number of systemic diseases, the number of remaining teeth, the position of dentures, and the experience of wearing dentures were key factors in the present study that were correlated with dental health behaviors. The results of this study provided useful information for dental health education and health care system to create optimal patient follow-up processes for patients wearing dentures in the future.

CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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DATA AVAILABILITY STATEMENT

All of the data generated and analyzed during this study are included in this article. Further enquiries can be directed to the corresponding author.

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