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A Survey on Knowledge, Attitude and Practice of Denture Care Among Elderly Patients

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ABSTRACT

As the elderly population grows, removable dentures remain an essential, viable, and economical option for replacing missing teeth. Enhancing patient understanding of denture care is essential for better oral and systemic health. This study aimed to evaluate the knowledge, attitude and practice of denture hygiene care among the geriatric denture users. A paper-based survey study was conducted on denture wearers aged 60 and above. Eligible participants, identified via convenience sampling, received a validated self-administered questionnaire about knowledge, attitude and practice of denture care that was translated into several languages. The study included 138 denture wearers, of which 60.9% were female and the remaining 39.1% were male. All participants cleaned their dentures at least once a day using mechanical (50.7%), chemical (25.4%), or combination methods (23.9%). Approximately 29.7% of the participants wore their dentures overnight. The mean knowledge score was relatively poor (46.5%) and was significantly associated with the denture cleaning method used, nocturnal denture use, and frequency of denture cleaning ($p < 0.05$). No association between a patient's gender and educational level and their attitudes and practices of denture care was observed ($p > 0.05$). In conclusion, geriatric denture wearers were showing a low knowledge score and were significantly associated to their denture hygiene protocols and the habit of nocturnal denture use. Enhanced knowledge delivery to elderly patients is essential to ensure a sustenance of good attitude and practices in denture hygiene.

Keywords: *Aged; dentures; health knowledge; hygiene; surveys and questionnaires.*

INTRODUCTION

The elderly population is increasing rapidly globally, the number of individuals aged more than 60 years increased from 3.3 million (10.3%) in 2020 to 3.8 million (11.3%) in 2023, with the Department of Statistics predicting that this proportion would continue to rise to over 15% of the total population by 2040 (Department of Statistics Malaysia, 2022, 2023). Although several European countries consider a person an elder once they are 65 years of age, Malaysia regards those aged 60 years and older as senior citizens in accordance with the 1982 United Nations World Assembly on Ageing (National Digital Department, 2023). As a result, various Malaysian ministries offer services tailored to senior citizens using this cut-off age, for example, an extensive subsidy from paying for medical and dental care at public healthcare facilities. The chronological age is an arbitrary concept and that the health status of older people may differ with the physical and mental capacities of the individual (Allen, 2019).

The Malaysian National Oral Health Survey of Adults (NOHSA) year 2010 showed that 78% of elderly individuals (aged more than 60 years) had less than 20 functional teeth and approximately 32.1% were fully edentulous in the year 2000 (Oral Health Division, Ministry of Health, 2011). Although the prevalence of edentulism is decreasing steadily due to improvements in the quality of healthcare services, this declining rates have been seen to vary between regions and countries due to differences in socioeconomic factors (Al-Rafee, 2020). This implies that the need for removable dentures remains relevant as they offer several benefits such as improved aesthetics, enhanced masticatory function, and greater psychosocial well-being (Ali *et al.*, 2019; Shaha *et al.*, 2021).

Oral hygiene maintenance as well as denture hygiene care can be challenging in the elderly population due to systemic diseases, polypharmacy, poor adaptability to changes, reduced cognitive function, and dependency on caretakers acting as barriers to attaining optimal oral health (Janto *et al.*, 2022). Patients with poor denture hygiene and nocturnal denture wearers have been previously found to be at increased risk of developing *Candida* spp.-associated denture stomatitis (Milward *et al.*, 2013; Cinquanta *et al.*, 2021; Ng *et al.*, 2021; Noor *et al.*, 2021; Manikandan *et al.*, 2022). Therefore, in addition to the mandatory provision of personalized oral and denture care instructions at the time of prostheses delivery, efforts should also be made to further reinforce these during recall visits to ensure satisfactory levels of hygiene (Kulak-Ozkan *et al.*, 2002; Milward *et al.*, 2013; Turgut Cankaya *et al.*, 2020).

Several studies have shown that sub-optimal denture hygiene practices and nocturnal denture use can be attributed to a lack of knowledge and education on appropriate care protocols among patients (Turgut Cankaya *et al.*, 2020; Konstantopoulou & Kossioni, 2023). Common denture cleaning techniques include manual brushing with denture specific toothpaste or neutral pH soap, immersion in various chemical solutions or effervescent tablets, and microwave sterilization have been advocated. The use of hot water to clean the denture or prolonged immersion in sodium hypochlorite solution should be avoided. A systematic review concluded that denture brushing and immersion in adjunctive chemical agents effectively remove plaque and microorganisms from the surface of the prostheses (Papadiochou & Polyzois, 2018). Hygiene protocols have typically been conveyed verbally or in written form at the time of denture delivery (Kulak-Ozkan *et al.*, 2002; Ng *et al.*, 2021). More recently, digital platforms such as mobile applications that use graphics and videos to provide oral and denture care instruction have been introduced to further improve patient knowledge of hygiene protocols (Ng *et al.*, 2022).

Although several studies have evaluated patient knowledge of denture hygiene practices among various populations, none have focused on geriatric patients in Kuala Lumpur to date (Kulak-Ozkan *et al.*, 2002; Milward *et al.*, 2013; Cakan *et al.*, 2015; Moussa *et al.*, 2022). Therefore, the current study aimed to assess the knowledge, attitude, and practice of denture hygiene maintenance among geriatric patients in Kuala Lumpur, Malaysia.

MATERIAL AND METHODS

This cross-sectional study was conducted in January to September 2022. Ethical approval was obtained from the university Research Ethics Committee (No: UKM PPI/111/8/JEP-2020-747) and informed consent was collected from all participants prior to the commencement of the study. The participants in this study were recruited using convenience sampling method. Patients who attended at the outpatient clinic, dental undergraduate and postgraduate students' clinics, and dental specialist clinics were selected, and the study included participants who was wearing removable dentures, aged 60 and above who attended as new or follow-up appointments. They should be able to comprehend self-administered paper-based questionnaires in English, Malay, or Chinese language. Patients with significant physical or mental disabilities that limited their ability to perform routine oral and denture care practices were excluded from the study. Eligible patients who had consented to participating in the study were provided with questionnaires in their preferred language and encouraged to complete them independently. Data on the patients' demographic characteristics and their knowledge, attitude, and practice of oral and denture hygiene protocols was collected.

According to the Department of Statistics, Malaysia, older individuals represented approximately 10% of the total population of Kuala Lumpur in 2019 and accounted for about 190,000 residents. Therefore, the minimum sample size necessary for a confidence level of 95% and a margin of error of 5% was 138 patients, calculated using the Raosoft® Sample Size Calculator (Raosoft Inc., 2022).

The current study modified a questionnaire used by a previous similar study focusing on the knowledge, attitude and practice of denture care among patients (Kulak-Ozkan *et al.*, 2002; de Castellucci Barbosa *et al.*, 2008; Cakan *et al.*, 2015). The paper-based questionnaire consisted of three sections. Section A included demographic data (10 questions) related to their general information, gender, educational level, race, nationality, denture wearing experiences, whether any denture hygiene instructions were provided, how those instructions were delivered. In section B, the knowledge component of the questionnaire included dichotomous responses of "Yes" or "No". The correct and incorrect answers were assigned scores of one and zero, respectively. The questions included if they knew to properly clean their dentures, whether plaque would form if residual food stuck under the denture, whether if the plaque can cause tissue irritation and if they know whether they can sleep with the denture or not. The total score for each patient was calculated and converted into a percentage of the maximum total score of 10. Section C covered the attitude and practice (10 questions for partial denture wearers, 9 questions for complete denture wearers and 19 questions for patients with a combined type of prostheses). This includes the methods of denture cleaning, frequency of denture cleaning, nocturnal use of denture and its frequencies, method of storing dentures, and whether denture cleansing agents were utilised. Additional questions for partial denture users include their teeth brushing habits, risks for teeth decay, frequencies of seeking professional care and expectations on the life expectancy of their denture.

For complete denture wearers, they were asked if their denture was loose, if they were happy with their denture and if they thought they needed a new denture. For respondents wearing both partial and full dentures, they were required to answer all the questions. Three prosthodontists carried out content and face validation ensure that the content of the questionnaire was easy to understand and sufficiently measured the domain of interest. The questionnaire was prepared in English language, then translated into Malay and Chinese language by a certified translator. One of the authors reviewed the translated version for clarity, accuracy, and cultural appropriateness. Second certified translator who is proficient in the three languages independently translate the questionnaire from the target language back into the source language. The authors reviewed the consistency of terminology between the original and backward-translated to ensure accuracy and maintain the intended meaning. A pilot study was carried out with a sample size of 15 participants with similar inclusion and exclusion criteria. Minor amendments were done to improve the clarity of the questions based on the feedback received. The data acquired during the pilot stage was excluded from the main study.

All the collected data were imported into statistical software (Statistical Package for Social Sciences, SPSS, Version 28, IBM, USA) for analysis with significance level set at $\alpha = 0.05$. The distribution of data were not normally distributed (Shapiro–Wilk test, $p < 0.001$), therefore, statistical analyses were carried out using non-parametric tests. Chi-square test was used to analyse the association between practice and attitude components with gender and education level. The association between knowledge scores and various variables were analysed using Mann-Whitney U test and Kruskal-Wallis H test.

RESULTS

Demographic characteristics

A total of 138 questionnaires were completed with no missing data, hence a 100% response rate, making them eligible for data analysis. Of these, 60.9% were completed by female respondents and the remaining 39.1% were completed by male respondents. The mean age of the study sample was 68.6 (SD: 6.2) years. Half (50%) of the respondents had attended secondary school, 29.7% had been educated up to primary school, and 20.3% had received tertiary education. Most participants had experiences in wearing removable dentures with more than 69.5% of them worn dentures for at least 5 years and above. High majority (81.2%) of the participants have been instructed on how to clean their dentures mainly in the form of verbal instructions (93.8%) upon receiving their new dentures. Table 1 summarizes the demographic data of the respondents.

Table 1 Sociodemographic data of the respondents

Demographic Data (N=138)	Frequency (n)	Percentage (%)
Gender		
Male	54	39.1
Female	84	60.9
Ethnicity		
Malay	76	55.1
Chinese	49	35.5
Indian	12	8.7
Others	1	0.7
Level of Education		
Primary	41	29.7
Secondary	69	50.0
Tertiary	28	20.3
Age		
65-75	120	87.0
Above 75	18	13.0
How long have you been wearing your denture?		
Less than 1 year	16	11.6
1 to 5 years	26	18.8
5 to 10 years	37	26.8
10 to 20 years	29	21.0
More than 20 years	30	21.7
Types of dentures worn		
Partial dentures	54	39.1
Complete dentures	53	38.4
Combination (partial against a complete denture)	31	22.5
Have you ever been instructed on how to clean your denture by a dentist?		
Yes	112	81.2
No	26	18.8
How are the instructions given to you?		
Verbal	105	93.8
Written	2	1.8
Verbal and written	3	2.7
Others	2	1.8

Knowledge on denture hygiene maintenance among geriatric patients

The participants had an overall knowledge score of 46.3% (SD: 13.1). The distributions and the frequency of answers for the knowledge component as presented in Table 2. Most patients do know how to clean their dentures well (97.8%) with majority answered that they can clean their dentures with brushing with water (65.9%) and brushing with water and soap (93.5%). Only 50% are aware that denture cleansing tablet can keep their dentures clean. A good majority of the participants do know that food stuck under the denture can form plaque (74.6%) and this plaque can cause irritation (73.9%). About 30.4% of the participants think that it is appropriate to wear their dentures to sleep at night. Table 3 shows the relationship between knowledge score and the attitude and practice of

denture care. Female participants scored 47.4% (SD: 11.8) and this was slightly higher than the scores observed among male participants (44.6%; SD: 14.9). However, this difference was not statistically significant. The patients' duration and experience of denture-wearing and whether they had received denture care instructions or not had no significant effect on their knowledge scores. However, the level of education was seen to significantly affect the knowledge scores ($p = 0.034$), with post-hoc analyses showing statistically significant differences in scores upon comparison of patients with primary versus secondary education and those with secondary versus tertiary education.

Table 2 The distribution and frequency of responses in the knowledge component

Questions	**Frequency of answers (n=138)**	
	Yes (n (%))	**No (n (%))**
I can clean my denture with:		
I do not know how to clean my denture	3 (2.2)	135 (97.8)
Brush with water	91 (65.9)	47 (34.1)
Brush with toothpaste	65 (47.1)	73 (52.9)
Brush with water and soap	129 (93.5)	9 (6.5)
Soak in water and denture cleansing tablet	69 (50.0)	69 (50.0)
Soak in diluted disinfectant solution (like Clorox)	1 (0.7)	137 (99.3)
Soak in diluted vinegar solution	2 (1.4)	136 (98.6)
Do you know food stuck under the denture could form the plaque?	103 (74.6)	35 (25.4)
Can plaque cause any irritation when you do not remove it from the denture while wearing it?	102 (73.9)	36 (26.1)
I can wear my denture to sleep at night.	42 (30.4)	96 (69.6)

Table 3 The relationship between the knowledge score, and attitude and practice towards denture hygiene care

Demographic, practice and attitude in denture care	n	%	Knowledge score (%) mean	SD	F statistic (df)	*p* value
Demographic						
Gender					-	0.261[B]
Male	54	39.1	44.6	14.9		
Female	84	60.9	47.4	11.8		
How long have you been wearing your denture?					1.867 (4)	0.760[A]
Less than 1 year	16	11.6	41.9	15.6		
1 to 5 years	26	18.8	46.5	12.6		
5 to 10 years	37	26.8	45.7	14.6		
10 to 20 years	29	21.0	47.2	12.2		
More than 20 years	30	21.7	48.3	11.2		
Level of education					6.741 (2)	0.034*[A]
Primary	41	29.7	48.8[a]	13.8		
Secondary	69	50.0	43.2[ab]	12.3		
Tertiary	28	20.3	50.4[b]	12.6		
Attitude component						
How many times do you need to seek a dental check-up?					5.518 (3)	0.138[A]
Once a year	22	25.9	45.5	11.4		
Twice a year	25	29.4	50.4	11.0		
Three times a year	7	8.2	44.3	16.2		
Only when your mouth or teeth feel uncomfortable	31	36.5	42.6	13.2		
Practice component						
Have you ever been instructed on how to clean your denture by a dentist?					-	0.340[B]
Yes	112	81.2	47.0	12.5		
No	26	18.8	43.5	15.5		
Frequency of denture cleaning					11.555 (3)	0.009*[A]
Once daily	42	30.4	42.6[a]	13.1		
Twice daily	58	42.0	45.7[b]	13.0		
Three times daily	21	15.2	53.3[ab]	14.6		
More than three times	17	12.3	48.8	7.8		
Methods of cleaning the denture					14.724 (2)	<0.001*[A]
Mechanical only	70	50.7	42.1[ab]	12.0		
Chemical only	35	25.4	50.6[a]	13.3		
Chemo-mechanical	33	23.9	50.6[b]	12.7		
Sleeping with dentures overnight					-	0.001*[B]
Yes	41	29.7	39.5	12.8		
No	97	70.3	49.2	12.2		

How do you keep your dentures?					16.681 (5)	0.005*[A]
I always wear my dentures	17	12.3	37.7[abc]	11.5		
Container with water	92	66.7	46.0[ad]	13.5		
Container with soap water	1	0.7	50.0	-		
Container with water and denture cleansing tablet	21	15.2	53.3[bd]	10.2		
Leaving the denture dry	4	2.9	45.0	5.8		
Others	3	2.2	56.7[c]	5.8		
Brushing the natural teeth						
Yes	83	97.6	45.8	12.7	-	0.917[B]
No	2	2.4	45.0	7.1		

SD: standard deviation;
(*) Indicates a statistical significance ($p < 0.05$)
([A]) Kruskal-Wallis H test
([B]) Mann-Whitney U test
Same superscripted lowercase indicates statistical difference among variables for pairwise comparison

Attitude and practice on denture hygiene maintenance among geriatric patients

Among respondents who retained at least one natural tooth and wore either partial denture with or without opposing complete dentures (n = 85), the majority (97.6%) reported brushing their teeth regularly and two participants did not brush their teeth on daily basis. Out of those, 36.5% reported not undergoing routine dental check-ups and visiting the dentist only when their mouth or teeth feels uncomfortable. Female participants (38.8%) have higher percentage to attend regular dental check-up compared to male participants (24.8%) (Table 3). More than half (64.3%) of the patients using complete dentures (n = 84) were happy with their current prostheses with more female participants (36.9%) are saying so, while 77.4% of them reported needing a new set. Majority of male participants only clean their denture once a day (16.7%). In contrast, most female participants clean their denture twice a day (27.5%). The most preferred methods of cleaning the dentures among both female and male was mechanical cleaning only. Of the participants, 29.7% reported to use their dentures nocturnally of which, 13.0% of them were males. The majority (66.7%) of the participants reported storing their dentures in a container with water when not in use. This was the most prevalent method of storing dentures regardless of the gender. Fewer patients stored their dentures in soap water (0.7%), left them out to dry (2.8%), or used other methods of storage (2.1%). Chi-square test revealed no significant association between the variables except for the gender and the need for new dentures (Table 4).

Table 4 The distribution of the relationship between gender and participants' attitude and practice towards denture hygiene care

Variables in practice and attitude	Gender (n (%))		Test statistic	*p value*
	Male (n=54 (39.1%))	Female (n=84 (60.9%))		
Attitude component				
How many times do you need to seek a dental check-up?			5.064	0.167
Once a year	6 (7.1)	16 (18.8)		
Twice a year	13 (15.3)	12 (14.1)		
Three times a year	2 (2.4)	5 (5.9)		
Only when your mouth or teeth feel uncomfortable	8 (9.4)	23 (27.1)		
Are you happy with your current denture?			0.130	0.719
Yes	23 (27.4)	31 (36.9)		
No	14 (16.7)	16 (19.0)		
Do you think you need a set of new dentures?			5.268	0.022*
Yes	33 (39.3)	32 (38.1)		
No	4 (4.7)	15 (17.9)		
Practice component				
Frequency of denture cleaning			6.868	0.076
Once daily	23 (16.7)	19 (13.8)		
Twice daily	20 (14.5)	38 (27.5)		
Three times daily	7 (5.1)	14 (10.1)		
More than three times	4 (2.9)	13 (9.4)		
Methods of cleaning the denture			0.319	0.582
Mechanical only	27 (19.6)	43 (31.2)		
Chemical only	15 (10.9)	20 (14.5)		
Chemo-mechanical	12 (8.7)	21 (15.2)		
Sleeping with dentures overnight			0.558	0.455
Yes	18 (13.0)	23 (16.7)		
No	36 (26.1)	61 (44.2)		
How do you keep your dentures?			1.387	0.926
I always wear my denture	8 (5.8)	9 (6.5)		
Container with water	35 (25.4)	57 (41.3)		
Container with soap water	0 (0.0)	1 (0.7)		
Container with water and denture cleansing tablet	8 (5.8)	13 (9.4)		
Leaving the denture dry				
Others	2 (1.4)	2 (1.4)		
	1 (0.7)	2 (1.4)		
Brushing the natural teeth			0.230	0.632
Yes	28 (32.9)	55 (64.7)		
No	1 (1.2)	1 (1.2)		

(*) Indicates a statistical significance ($p < 0.05$) using Chi-square test.

In the term of education level and the attitude and practice towards denture hygiene, participants with primary (15.3%) and secondary (14.1%) school level was among who do not attend any regular dental visits. Most participants who received tertiary education seeks for dental check-up twice a year and about 7.1% of them seek for dental treatment when their mouth or teeth feel uncomfortable (Table 5). Irrespective to their level of education, highest proportion of the participants cleaned their dentures twice a day. Interestingly, participants who clean their dentures three times a day (15.2%) scored significantly higher knowledge score compared to those who clean their denture once or twice a day (Table 3). Mechanical only denture cleaning was among the most favourite method of denture cleaning among participants with primary (15.9%) and secondary (27.5%) education. While for the tertiary education group, mechanical only (7.2%) and chemical only (7.2%) cleaning method shared the same preference. The least percentage of participants who use their denture nocturnally was from the tertiary educated group (5.8%). Seventeen respondents (12.3%) claimed that they wore their dentures all the time and only removed them for the purpose of cleaning with a majority 5.8% of them had secondary education. Regardless of the education level, storing dentures in a container with water was the most prevalent denture storage method when the denture is not in use. Chi-square test revealed no significant association between the variables (Table 5).

Table 5 The distribution of the relationship between educational level and participants' attitude and practice towards denture hygiene care

Practice and attitude in denture care	**Education level (n (%))**			**Test statistic**	***p value***
	Primary (n=41 (29.7%))	**Secondary (n=69 (50.0%))**	**Tertiary (n=28 (20.3%))**		
Attitude component					
How many times do you need to seek a dental check-up?				6.541	0.365
Once a year	4 (4.7)	15 (17.6)	3 (3.5)		
Twice a year	8 (9.4)	10 (11.8)	7 (8.2)		
Three times a year	2 (2.4)	4 (4.7)	1 (1.2)		
Only when your mouth or teeth feel uncomfortable	13 (15.3)	12 (14.1)	6 (7.1)		
Are you happy with your current denture?				0.547	0.761
Yes	19 (22.6)	23 (27.4)	12 (14.3)		
No	10 (11.9)	15 (17.9)	5 (5.9)		
Do you think you need a set of new dentures?				2.075	0.354
Yes	23 (27.4)	27 (32.1)	15 (17.9)		
No	6 (7.1)	11 (13.1)	2 (2.4)		
Practice component					
Frequency of denture cleaning				6.589	0.360
Once daily	10 (7.2)	23 (16.7)	9 (6.5)		
Twice daily	21 (15.2)	27 (19.6)	10 (7.2)		
Three times daily	8 (5.8)	10 (7.2)	3 (2.2)		
More than three times	2 (1.4)	9(6.5)	6 (4.3)		
Methods of cleaning the denture				3.465	0.483
Mechanical only	22 (15.9)	38 (27.5)	10 (7.2)		
Chemical only	9 (6.5)	16 (11.6)	10 (7.2)		
Chemo-mechanical	10 (7.2)	15 (10.9)	8 (5.8)		
Sleeping with dentures overnight				0.039	0.981
Yes	12 (8.7)	21 (15.2)	8 (5.8)		
No	29 (21.0)	48 (34.8)	20 (14.5)		
How do you keep your dentures?				7.459	0.681
I always wear my denture	5 (3.6)	8 (5.8)	4 (2.9)		
Container with water	29 (21.0)	44 (31.9)	19 (13.8)		
Container with soap water	1 (0.7)	0 (0.0)	0 (0.0)		
Container with water and denture cleansing tablet	6 (4.3)	11 (8.0)	4 (2.9)		
Leaving the denture dry	0 (0.0)	3 (2.2)	1 (0.7)		
Others	0 (0.0)	3 (2.2)	0 (0.0)		
Brushing the natural teeth				4.400	0.111
Yes	25 (29.4)	41 (48.2)	17 (20.0)		
No	2 (2.4)	0 (0.0)	0 (0.0)		

(*) Indicates a statistical significance ($p < 0.05$) using Chi-square test.

Fig. 1 shows the denture cleaning methods used by the participants. For mechanical cleaning methods, 41.3% of the denture wearers brush their dentures with only water, 39.1% with toothpaste and 4.3% with soap. Nearly half (44.9%) of the participants soak their dentures in water with denture cleansing tablet. Only 0.7% participants used disinfectant solution to soak their denture overnight. Additionally, 3.6% of the participants used other methods to clean their dentures including soaking in salt water. All participants clean their dentures at least once a day. Most patients cleaned their dentures twice a day (42.0%), once a day (30.4%), and three or more times a day (27.5%).

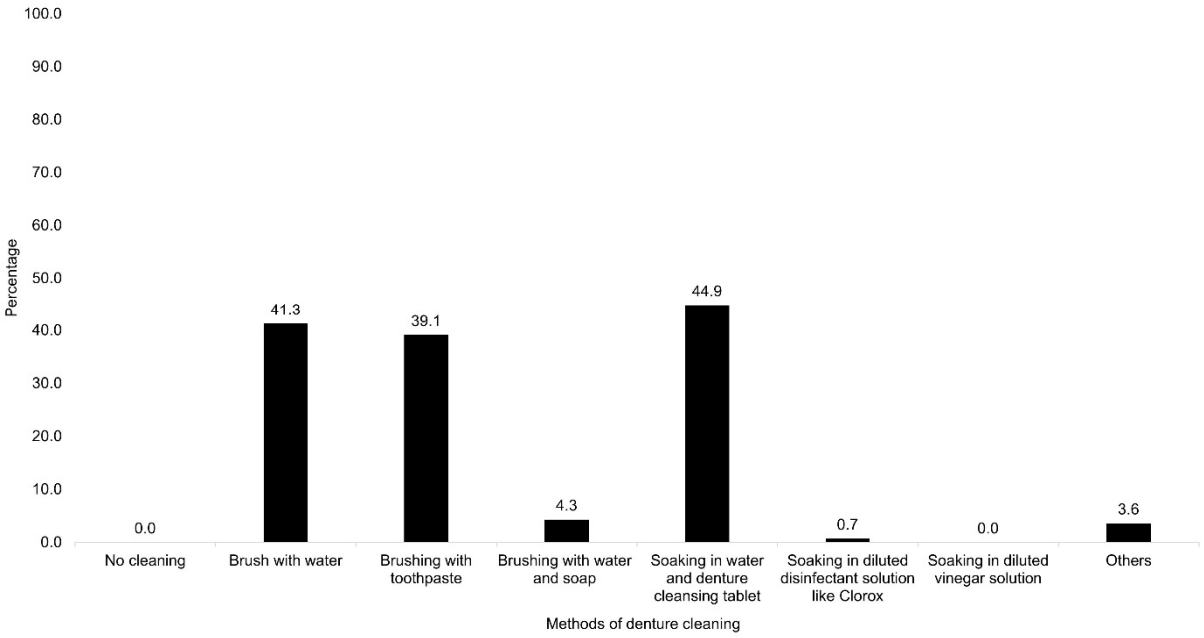

Fig. 1 The denture cleaning methods employed by the participants.

DISCUSSION

Good denture hygiene plays a critical role in ensuring a harmonious relationship between oral tissues and dental prostheses (Konstantopoulou & Kossioni, 2023). It also contributes to prolonging the duration of use of the device without increasing the risk of secondary oral or systemic diseases. This study allowed an assessment of the status of the knowledge, attitude and practice of denture hygiene among community-dwelling geriatric patients in Kuala Lumpur. The result of this study would prompt a new strategy for improving the knowledge, attitude and practice among geriatric patients in general. The majority of our respondents were happy with their dentures and those that were not satisfied attributed it to loose fit and requested replacements. This is in agreement with several other studies however the patients' satisfaction with their dentures may not reflect the actual denture condition (de Castellucci Barbosa *et al.*, 2008; Kosuru *et al.*, 2017). Therefore, an objective evaluation of the denture is often required.

The results of this study reflect the ineffectiveness of the denture care instructions delivered to patients, primarily given in verbal form. Patients received proper denture care instructions were likely to have a good denture hygiene (Noor *et al.*, 2021). It is part of the treatment protocol that every patient who receives dentures should be provided with denture care instructions accordingly by their dentist. Among the participants, whether first-time visitors or returning patient, 18.8% of them reported not receiving the instruction from their denture on how to clean their dentures. This finding suggests that we may be overlooking the attitudes of the dentist's themselves regarding the importance of providing denture care instruction during denture delivery. Limited knowledge of denture cleansing materials, low motivation and attitudes towards giving denture care instruction were among the reason why dentists may not feel compel to explain the denture care instructions (Suresan *et al.*, 2016). Previous studies among dental practitioners showed that the provision of verbal instructions to elderly people was difficult and often time consuming, suggesting that a combined approach of both verbal and written instructions may be preferable for this population (Kulak-Ozkan *et al.*, 2002; Turgut Cankaya *et al.*, 2020; Ng *et al.*, 2021). A modern approaches such as mobile applications incorporating simple and comprehensive written and video instructions on denture care, can be referenced to improve user understanding and engagement, thus potentially being more effective in educating older patients (Ng *et al.*, 2022).

The overall mean knowledge scores on denture hygiene among community-dwelling elderly were still relatively low in our study. Nonetheless, this is corroborated by a study conducted at Hong Kong (Wong, 2020). Interestingly, there were no significant differences observed in the knowledge scores among respondents who did not receive any denture care instructions. The respondents in this study reside in an urbanised metropolis and possibly having good accessibility to healthcare information and facilities. It was shown that a positive correlation exists between a good knowledge score and the apparent denture cleanliness and their oral hygiene level (Turgut Cankaya *et al.*, 2020; Wong, 2020). Therefore, it is imperative to increase the level of knowledge among denture wearers regardless of their formal educational level (Wong, 2020). A contemporary method in delivery denture care knowledge proven to increase patient's knowledge scores and eventual oral and denture hygiene (Ng *et al.*, 2021).

All participants in the current study reported cleaning their dentures at least once a day, and this was in agreement with several previous studies (Kulak-Ozkan *et al.*, 2002; Kosuru *et al.*, 2017; Namrata & Ganapathy, 2017; Turgut Cankaya *et al.*, 2020). This practice is also aligned with evidenced-based guideline for the care and maintenance of dentures recommended daily denture cleaning, which recommend daily denture cleaning to prevent harmful biofilm (Felton *et al.*, 2011). The frequency of denture cleaning does not necessarily determine the level of denture hygiene; instead, the cleaning method used has been found to play a greater role in the same (Verhaeghe *et al.*, 2020;

Noor *et al.*, 2021). The majority of the participants in the current study used purely mechanical methods or a combination of mechanical and chemical methods to clean their dentures. Both toothbrushes and toothpaste, widely accessible in the market, provide the simplest and most convenient method for denture cleaning. However, a non-abrasive denture cleanser is recommended, as using toothpaste, particularly whitening toothpastes that contain abrasive particles, is not advisable; it can scratch the surface of the denture and facilitate plaque accumulation (Felton *et al.*, 2011; Kundra *et al.*, 2017). Approximately 44.9% of the current study sample used denture cleansing tablets and these findings were consistent with those reported by Namrata & Ganapathy (2017) and Milward *et al.* (2013). In contrast, some other studies reported observing slightly lower percentages (Kundra *et al.*, 2017; Turgut Cankaya *et al.*, 2020). The utilisation of dedicated denture cleanser was seemed to be lower and it is probably due to the financial factors. Chemical cleaning alone has been found to be less effective than mechanical methods of cleaning, and a combination of the two has been shown to be the most effective way to remove denture plaque (Felton *et al.*, 2011; Verhaeghe *et al.*, 2020). Where effective chemo-mechanical cleaning methods are unsuitable due to poor manual dexterity, keeping the denture dry at night can reduce the *Candida* spp. count without inducing clinically significant changes in denture dimensions (Verhaeghe *et al.*, 2020). A poorly cleaned denture soaked in water potentially promotes *Candida* spp. growth and colonisation (Verhaeghe *et al.*, 2020).

Despite that the majority of the respondents received denture care instructions at the time of denture delivery, approximately one third of the respondents reported continuing nocturnal use of their prostheses. These findings aligned with a study conducted locally (Noor *et al.*, 2021), but contradicted other studies that reported a higher percentage of 49.7% of their respondents who continued to use their dentures nocturnally (Milward *et al.*, 2013; Turgut Cankaya *et al.*, 2020). Notably, 12.3% of the current study sample reported using their dentures all the time and removing them only for the purpose of cleaning. This percentage was considerably larger than that observed in previous studies, which reported proportions ranging from 7.5% to 10.0% (Kulak-Ozkan *et al.*, 2002; Kundra *et al.*, 2017; Namrata & Ganapathy, 2017). This is a concern, as nocturnal use of a denture has been shown to increase the risk of lower respiratory tract infections by 2.3 fold in geriatric patients, due to the potential aspiration of the oral microbiome leading to hospitalisation and death (Pathak *et al.*, 2021).

Most patients in this study were unaware of the need for annual routine dental examinations, with 36.5% of them reporting visiting the dentist only when the mouth or teeth feels uncomfortable. Potential explanatory factors include a lack of awareness, the associated financial burden, dependency, accessibility to dental services, dental fear, or prioritization of comorbidities (Janto *et al.*, 2022). The perception that denture teeth may not have as many problems as the natural dentition could also play a role in infrequent dental visits (Kulak-Ozkan *et al.*, 2002). The effort to attend regular dental check-ups decreases as age advances, consequently increasing the burden on dental healthcare systems (Wong, 2020). Patients with less than 20 functional teeth who did not use dentures were seen to be at a higher risk of falling, developing dementia, or exhibiting poor nutritional intake, and these risks were significantly reduced once dentures were worn (Atanda *et al.*, 2022).

Although self-administered questionnaires are widely used for the assessment of patient knowledge and practice of denture care, they are limited by an increased risk of bias with patients often providing positive responses that may not reflect their actual practices accurately. This may be considered a limitation of the current study. In addition, clinical examination of the dentures which were absent in this study, would allow objective evaluation of the correlation between the patients' responses and the actual prostheses hygiene levels and the patients' perception and the actual condition of their denture. Another limitation of this study was that it used convenience sampling in a university setting, thus restricting the generalizability of the findings to the wider elderly population.

The findings of this study suggest that elderly patients have limited knowledge of denture care protocols and this is reflected in their daily practice of oral and denture hygiene maintenance. Dentists play a crucial role and hold the responsibility of providing comprehensive knowledge on denture care to patients. Innovative ways to educate denture patients, such as those incorporating validated digital information delivery systems, are necessary in addition to conventional way to ensure the standardization of information and effectiveness of delivery to patients. Future studies should conduct similar research incorporating oral and denture examinations among patients from different localities and at different time periods, to assess the effectiveness of any changes implemented.

CONCLUSION

The mean knowledge scores among denture wearers were relatively low and were significantly associated to their poor denture hygiene practices particularly in the denture hygiene protocols and the habit of sleeping with dentures at night. Enhanced knowledge delivery to elderly patients is essential to ensure a sustenance of good attitude and practices towards denture hygiene care.

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