



## Hygiene Behavior of Complete Denture Wearers and Distribution of Plaque on Their Denture's Tissue Surface within Three-month after Denture Delivery

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### Abstract

Removable denture wearers were found to have poor denture hygiene practices and denture cleanliness, which contributed to infections and other health issues. This study aims to determine the characteristics and behavior of the patients wearing a complete denture and the distribution of plaque on the denture's tissue surface. Forty participants who came to the Prosthodontic Clinic of Chulalongkorn University and requested a new complete denture were interviewed via questionnaire, including their general information and hygiene habits during the recheck steps (within 3 months after denture delivery). Sixty-five dentures, 35 maxillary dentures and 30 mandibular dentures were disclosed using 5% erythrosine dye in the tissue surface to reveal plaque deposition. Plaque scores were assessed using the Schubert and Schubert index. The subjects of this study were mostly female, unemployed, and enrolled in the primary school. Their average age was  $70.9 \pm 7.9$  years. Most of the subjects removed their dentures at night and cleaned by brushing them with toothpaste. Half of them had not received denture hygiene instructions from their previous dentists and most patients were unaware of routine denture check-ups. The most plaque deposition areas were the vestibular incline of the labial flange of the maxillary denture and the lingual incline of the posterior lingual flange of the mandibular denture. As a result, self-care and maintenance of removable dentures seem to be misunderstood, and most patients are unaware of their importance, which leads to poor denture hygiene habits. Since some denture areas are more likely to get stained than others, dentists should pay more attention to providing denture care instructions.

**Keywords:** *Denture hygiene, Complete denture, Denture cleanliness*

### 1. Introduction

Thailand's national survey (Bureau of Dental Health, 2018) found that the amount of fully edentulous patients has increased in people aged over 60 years old, which affects their functions and quality of life. Even though there are many treatment options to replace missing teeth, including implant-supported or retained dentures, most of the edentulous people in Thailand still prefer conventional acrylic-based removable complete dentures because of the cost, medical welfare, simple procedure, and treatment time length.

Regular denture hygiene care is an important factor in maintaining oral health and the long-term use of removable prostheses (Cankaya, Yurkados, and Kalabay, 2020). Oral hygiene and denture hygiene affect the quality of life, nutrition, socialization, and general systematic health significantly (Felton et al., 2011). As an acrylic denture, the tissue surface of dentures has the greatest potential to accumulate debris and microorganism, so plaque tends to build on the tissue surfaces rather than the polished surfaces (Budtz-Jørgensen and Theilade, 1983; Jeganathan et al., 1996). The plaque accumulation on denture is associated with denture age significantly (Hoad-Reddick, Grant, and Griffiths, 1990). The lack of denture cleanliness can lead to poorer oral health and general health problems. In addition to poor oral hygiene and bad breath, plaque on tissue surface can increase the risk of oral infections and diseases, including periodontitis or denture stomatitis, and lead to life-threatening conditions such as aspiration pneumonia. (Duyck et al., 2016)

However, denture wearers have been found to have poor denture hygiene habits. Many studies revealed that several denture wearers could not clean their dentures properly, never received denture hygiene instructions, and had poor denture cleanliness (Duyck et al., 2016; Hoad-Reddick et al., 1990; Mylonas, Afzal, and Attrill, 2014). According to Thailand's national survey, it was found that 21.2% of denture wearers did not clean their dentures and 20% only rinsed their dentures with water (Bureau of Dental Health, 2018).

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Furthermore, there are more studies indicating that more than half of patients did not remove dentures at night (Cankaya et al., 2020; Papadiochou and Polyzois, 2018), which is significantly associated with denture stomatitis (Methanopphakhun, 2019).

Although there have been many studies on the behavior of denture wearers all around the world, data on the Thai population is limited. While it has been proven that plaque accumulation on denture causes infection of oral tissue, there has been little research on the plaque deposition area on complete dentures, thus leading to this study.

## 2. Objectives

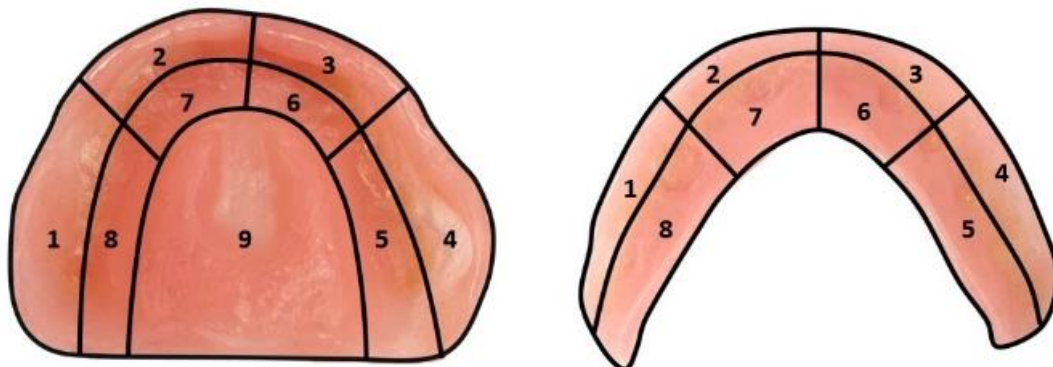
- 1) To determine characteristics and denture hygiene habits among patients wearing a complete denture.
- 2) To describe the distribution of plaque on the tissue surface of denture.

## 3. Materials and Methods

This study was a cross-sectional study conducted in the Prosthodontics Department of Chulalongkorn University, including 40 patients who were attending for new acrylic-based complete dentures or single dentures. Exclusion criteria were disability patients who were unable to clean their dentures themselves and dentures that had been relined. All patients were provided with a written consent for the research project. Prior to the clinical examination, subjects were interviewed to complete a questionnaire that included their general information, habits, denture experience, and denture self-care. The examination took place during the recheck steps, which occurred within three months after denture delivery. The patients were given hygiene instructions by their dentist as a regular procedure in denture delivery visit. This study was approved by the Human Research Ethics Committee of the Faculty of Dentistry, Chulalongkorn University, Bangkok, Thailand.

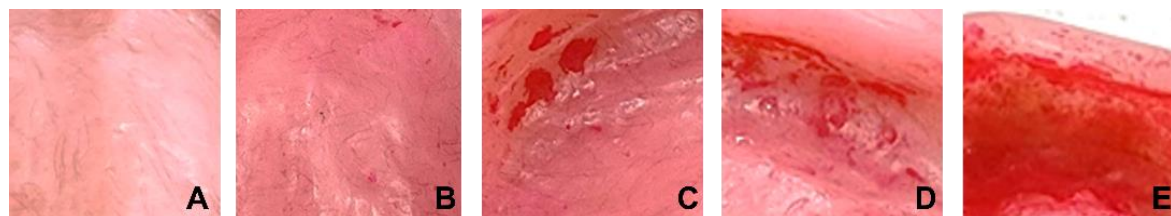
A total of 65 dentures (35 maxillary complete dentures and 30 mandibular complete dentures) were examined and scored for cleanliness. The cleanliness score was assessed using the Schubert and Schubert index (Schubert and Schubert, 1979), which inspected the tissue surface of the denture. After rinsing the denture to remove excess food debris, 5% erythrosine dye was applied to the denture surface to accurately reveal plaque. The denture was washed in running water and dried with an air blow to remove any excess dye. The tissue surface of the denture was photographed and labeled with a number with no identification of the patient for the purpose of blinded assessment.

The denture surface was divided into nine areas in the upper denture and eight areas in the lower denture (excluding the palatal part), as seen in Figure 1. Each segment was evaluated and scored from 0 to 4 points; 0 = no plaque, 1 = a few spots of plaque, 2 = less than half an area covered with plaque, 3 = more than half an area covered with plaque, and 4 = all area covered with plaque, as seen in Figure 2.



**Figure 1** Divided areas in the complete denture to score the cleanliness (left; maxillary denture, right; mandibular denture)

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**Figure 2** An example of cleanliness score; A = score 0, B = score 1, C = score 2, D = score 3, E = score 4

For the statistical analyses, IBM SPSS Statistics version 22.0 was used. The characteristics of the participants and dentures were described using descriptive statistics, including frequency and percentage for categorical data and means and standard deviations or median, maximum, and minimum for continuous data.

#### 4. Results and Discussion

##### 4.1 Results

In this study, 67.5% of the subjects were female. The average age of the patients was  $70.9 \pm 7.9$  years (range: 53 – 85 years). Most of the patients were unemployed and nearly half of them attended the primary school. In terms of smoking and drinking coffee or tea, 80% said they never smoked and 66.5% said they routinely drank coffee or tea (see Table 1).

**Table 1** The characteristics of the subjects (n = 40)

		n	%
Gender	male	13	32.5
	female	27	67.5
Age	<60	5	12.5
	61-70	14	35.0
	71-80	18	45.0
	>80	3	7.5
Education level	illiterate	4	10.0
	primary school	17	42.5
	secondary school	11	27.5
	higher than secondary school	8	20.0
Occupation	unemployed	31	77.5
	employed	9	22.5
Smoking	no	32	80.0
	used to	7	17.5
	yes	1	2.5
Coffee/tea drinking	no	15	37.5
	tea	1	2.5
	coffee	16	40.0
	coffee and tea	8	20.0

Regarding denture experience, 22.5% of participants reported having never worn a denture before. For the patients who had at least one prior denture (n = 31), most of them had been using it for more than 20 years (denture age range: 4 – 35 years). It was also found that most dentures (58.1%) were used for less than 5 years and 6.5% of patients used the same denture for over 10 years. Additionally, there were a few patients reporting that their last denture was made by a technician, as shown in Table 2.

Half of the patients wearing dentures reported never having received denture hygiene care instructions. There were 12.5% of the participants who wore dentures overnight. Almost all patients brushed their dentures. The most common detergent used was toothpaste followed by liquid soap and dishwashing

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liquid. Ten percent of patients brushed their dentures with water. An additional denture cleaning tablet was used by 20% of patients. Only 10% of patients were aware of the necessity of routine denture checkups.

**Table 2** Denture experience and habits

		n	%
Denture experience n = 40	no experience	9	22.5
	has old denture	31	77.5
Edentulism age n = 31	< 10 years	10	32.2
	10 - 20 years	8	25.8
	> 20 years	13	41.9
Last denture age n = 31	< 5 years	18	58.0
	6 - 10 years	11	35.5
	> 10 years	2	6.5
Last denture fabricated clinic n = 31	government hospital	2	6.5
	private clinic	13	41.9
	university hospital	14	45.1
	technician	2	6.5
Received denture hygiene instructions n = 31	no	17	54.8
	yes	14	45.2
Remove denture overnight n = 40	no	5	12.5
	yes	35	87.5
Keep denture outside the mouth at night n = 35	keep dried	0	0.0
	soak in water	35	100.0
Cleaning method n = 40	brush	39	97.5
	cotton or sponge	1	2.5
Detergent n = 40	toothpaste	20	50.0
	liquid soap	13	32.5
	dishwashing liquid	3	7.5
	water	4	10.0
Denture cleaning tablet n = 40	no	32	80.0
	yes	8	20.0
Denture check-up n = 40	no	36	90.0
	yes	4	10.0

For denture cleanliness, the area found to be the most stained was the vestibular incline of the left and right labial flange (Figure 1 left; area 2 and 3) which had a quarter of score 2, followed by the vestibular incline of the left and right buccal flange (Figure 1 left; area 1 and 4) in the maxillary complete denture. In the mandibular denture, half of the denture was stained in the lingual incline of the left and right posterior lingual flange (Figure 1 right; area 5 and 8) and the vestibular incline of the left and right labial flange (Figure 1 right; area 2 and 3). Table 3 below displays the distribution of plaque scores on tissue surface of denture.

**Table 3** The distribution of plaque scores on tissue surface of denture (%)

	Area on maxillary complete denture (n=35)								
	1	2	3	4	5	6	7	8	9
score: 0	54.3	34.3	37.2	60.0	68.5	62.9	62.9	74.3	71.4
1	34.3	34.3	31.4	25.7	25.7	25.7	25.7	20.0	25.7
2	11.4	25.7	25.7	14.3	2.9	8.5	11.4	5.7	2.9
3	0.0	5.7	5.7	0.0	2.9	2.9	0.0	0.0	0.0

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Area on maxillary complete denture (n=35)									
	1	2	3	4	5	6	7	8	9
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total stain	45.7	65.7	62.8	40.0	31.5	37.1	37.1	25.7	28.6
Area on mandibular complete denture (n=30)									
	1	2	3	4	5	6	7	8	
score: 0	70.0	56.6	46.7	73.4	53.3	63.3	66.7	50.0	
1	26.7	26.7	43.3	23.3	16.7	26.7	26.7	26.7	
2	3.3	10.0	6.7	3.3	30.0	6.7	3.3	23.3	
3	0.0	6.7	3.3	0.0	0.0	3.3	3.3	0.0	
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total stain	30.0	43.4	53.3	26.6	46.7	36.7	33.3	50.0	

#### 4.2 Discussion

In this survey, one-fourth of the patients had no prior denture experience. Most people who wore dentures had been using them for longer than 20 years. More than half of patients reported using the last denture for under five years, but a small percentage of participants reported using the same denture for over ten years. It has been suggested that dentures should not be worn for over 5 years. A study revealed that the cleanliness of dentures is adversely affected by denture age. The hygiene of older dentures is significantly worse (Cankaya et al., 2020). There were a small number of patients whose recent dentures were made by technicians outside the clinic. In contrast, a study by Osmari et al. (2016) found that nearly half of the patients had their dentures made by a prosthesis technician. This may be due to this study conducted in an urban area in which patients have easy access to dental care.

For the denture care protocol, the oral health foundation reviewed denture hygiene care instructions around the world and developed the guidelines for denture wearers in 2018 consisting of 4 steps. First, daily clean the dentures with a toothbrush and an effective non-abrasive detergent. Second, daily soak the dentures in a denture-cleaning solution. Third, remove the dentures overnight except for specific reasons. Last, enroll in a regular recall and maintenance program (Bartlett et al., 2018).

In this study, more than half of the patients said they had never been given denture care instructions. Two-thirds of the patients who received instructions mentioned that their dentures were made by a dental student in a university hospital. This could be because, in a university setting, dental students have fewer patients to care for, giving them more time to instruct patients. Furthermore, as a department requirement, hygiene instructions must be provided during a denture delivery appointment. In contrast to service hospitals, whether private or public, which have a greater number of patients, dentists have less time to spend with patients and may overlook the importance of instruction. The lack of instruction is reflected in the inappropriate self-denture hygiene care of the patients. Although the guidelines suggest removing dentures overnight, 5 patients out of 40 reported wearing dentures at night. Some of them stated that they were uninformed to remove the dentures, while others claimed they wore them for aesthetic reasons. All the patients removing dentures at night reported soaking their prostheses in water which is a suitable way to keep dentures when outside the mouth.

For the cleaning methods, this study demonstrated a greater number compared to Thailand's national survey in 2018. That is, nearly all the participants cleaned their dentures by brushing with a toothbrush. Even though the recommended detergent used is a non-abrasive agent, half of the patients used toothpaste to clean their dentures which considered an abrasive detergent that can irritate the denture. Only 10 percent brushed with water without any chemical additives, with a minority using denture cleaning tablet additionally. This could be explained by the fact that toothpaste is simple, easy to use, and inexpensive; likewise, it might be related to the way natural teeth are typically cleaned (Cinquanta et al., 2021; Osmari et al., 2016).

Regular denture recall is the last recommendation for denture care. The oral tissue has changed over time as a result of ridge resorption, which causes dentures to lose and not fit properly in the mouth. This can cause irritation of the oral tissue and the deposition of plaque, which can easily lead to infection (Namano,

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2537). That is why patients should return for regular denture checkups. Moreover, a dentist can re-evaluate the patients' oral and denture hygiene, motivate them, and provide additional instructions. However, less than 10% of the patients in this study were aware of routine denture checkups. Similar to other studies (Methanopphakhun, 2019; Osmari et al., 2016), only a small percentage of patients regularly checked on their dentures. Most of them no longer see the dentist unless there is a problem with their dentures. Apparently, individual instruction loses its effectiveness over time so re-motivation is needed (Zenthöfer et al., 2013).

For denture cleanliness, most of the dentures had good satisfactory denture hygiene. According to Hoard-Reddick et al. (1990), the amount of biofilm accumulation is related to how long a denture has been worn. The evaluation of the dentures during the recheck period within three months after fabrication might be one of the factors. Another issue is that this study was conducted in a dental school in which every patient had been informed by the dental students to clean their dentures during the delivery visit. However, some areas of denture retained a greater amount of plaque deposit. The highest amount of plaque was found on the vestibular incline of the labial flange in the maxillary denture (Figure 1 left; area 2 and 3) and the lingual incline of the posterior lingual flange in the mandibular denture (Figure 1 right; area 5 and 8) which had stain for more than half with the scores of 2 and 3, which are considered high for the new denture. Following the vestibular incline of the buccal flange in the maxillary denture (Figure 1 left; area 1 and 4) and the vestibular incline of the labial flange in the mandibular denture (Figure 1 right; area 2 and 3), most of the scores were 1, referring to a few spots of plaque, which is acceptable.

Regarding the design of the denture, plaque accumulates more easily on the tissue surface of acrylic-based dentures because of its porously non-polished surface and anatomy of the gingiva, including the rugae area, the saliva gland opening, and the tissue undercut. The vestibular incline of the labial flange and retromolar pad area is considered to be concave which is difficult to clean and most patients forget to brush this area. Since the position of the brush is commonly placed vertically to the denture base, making it nearly impossible to clean the vestibular incline of the flange. Additionally, some patient's residual ridges are narrow which makes it hard to clean the ridge impression with a standard brush, so using a small cross-sectional bristle brush is recommended individually.

As a result, there are still misunderstandings regarding the self-care and maintenance of removable dentures, and most people are unaware of their necessity, which result in improper hygiene practices. Therefore, dentists should pay greater attention to providing denture care instructions, and since some areas of denture are most likely to be stained, dentists should encourage patients to clean properly.

## 5. Conclusion

Most of the patients brushed their dentures with a toothbrush and toothpaste, rarely used denture cleaning tablets, removed their dentures at night, and were unaware of a routine checkup. The vestibular incline of the maxillary denture's labial flange and the lingual incline of the posterior lingual flange in mandibular denture showed the most stained area.

Dentists should focus more on providing denture care instructions and ensuring that patients understand correctly. Besides, patients should be motivated during the recheck steps, so that they can take care of their dentures on their own throughout the maintenance phase.

The limitation is that this study was conducted in a university hospital setting in the city's central area and patients who visit the university hospital seem to have a positive attitude and more time for treatment than others, hence the results may not be generalizable to the entire population. Further studies should investigate the attitudes and behavior of denture wearers in other regions of Thailand.

## 6. Acknowledgements

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