

Factors Associated With Periodontal Diseases and Oral Hygiene Status Among Community-Dwelling Adults With Physical Disabilities in Thailand: A Cross-Sectional Study

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Abstract

Objective: There is limited evidence concerning oral health among disabled people capable of independently performing oral hygiene practices. This study investigated factors associated with periodontal diseases and oral hygiene status among community-dwelling, working-age Thai adults with physical disabilities.

Material and Methods: A cross-sectional study was conducted between 1st February to 15th March 2018 at the Community Center for Independent Living, a disability community club located in Pathum Thani province, Thailand. A total of 198 adults with physical disabilities completed self-report questionnaires. Occurrence of bleeding on probing and presence of dental plaque accumulation were obtained through full-mouth periodontal examinations by a trained and calibrated examiner. Univariate and multivariate binary logistic regression were performed.

Results: Toothbrushing frequency of less than twice per day was associated with periodontal diseases (OR = 8.25, $p = 0.001$). Higher levels of sweets consumption (OR = 3.17, $p = 0.003$) and infrequent toothbrushing (OR = 4.26, $p = 0.001$) were related to poor oral hygiene.

Conclusions: Participants who performed improper oral health behaviors would suffer from periodontal diseases and poorer oral hygiene status. Although participants are capable of performing daily self-care, their physical limitation is a possible explanation for difficulty in appropriate personal oral hygiene practices, which can lead to a lower quality of oral cleanliness. Therefore, professional oral health education and personal oral hygiene instruction tailor-fit to their specific needs are necessary to increase the quality of toothbrushing practices and proper oral health behaviors among persons with physical disabilities.

Keywords: periodontal disease, oral hygiene, adults, physical disability, Thailand, a cross-sectional study

1. Introduction

According to the WHO global disability action plan 2014-2021, there are approximately one billion disabled people globally (WHO, 2015). Existing studies report that people with disabilities have poorer oral health than people without disabilities (Chen et al., 2016; Pan et al., 2017; Rashid-Kandvani, Nicolau, & Bedos, 2015). These disabled people live in complex circumstances depending on the severity of their disabilities, including difficulty functioning, experiencing a combination of diseases (Dougall & Fiske, 2008a) and deficiencies in well-organized dental care services for people with special needs (Rashid-Kandvani et al., 2015; Sermsuti-Anuwat & Pongpanich, 2018a, 2018b). Previous studies suggest that due to disability-related limitations in daily life, persons with disabilities exhibit improper oral health behaviors that lead to the onset of periodontal diseases (El Tantawi & AlAgl, 2017; Kothari et al., 2017).

Furthermore, because of the difficulties of daily oral hygiene practices (Gil-Montoya et al., 2016; Jang et al., 2015) and barriers to accessing dental care services (Dougall & Fiske, 2008a; Leal Rocha, Vieira de Lima Saintrain, & Pimentel Gomes Fernandes Vieira-Meyer, 2015; Rashid-Kandvani et al., 2015; Sermsuti-Anuwat & Pongpanich, 2018b; Yuen et al., 2010), adults with disabilities are at a higher risk, as they also tend to consume increased quantities of sugar-sweetened beverages (Kim, Park, Carroll, & Okoro, 2017).

Much dental research has focused on children with special needs (Leroy & Declerck, 2013) and elderly adults with disabilities (Gil-Montoya et al., 2016), including those persons living dependent-care settings (Kothari et al., 2017) and in an institution for the disabled (Bizarra & Ribeiro, 2009). With regard to the oral health of persons with physical disabilities, few studies have investigated the difficulties in accessing dental services (Chen et al., 2016; Leal Rocha et al., 2015; Rashid-Kandvani et al., 2015; Sermsuti-Anuwat & Pongpanich, 2018b). However, proper daily oral hygiene practices are necessary for persons with a permanent disability (Dougall & Fiske, 2008b; Kothari et al., 2017; Pan et al., 2017). There is limited evidence regarding the factors associated with periodontal diseases and oral hygiene status among independent, community-dwelling, adults with physical disabilities, who are capable of performing their own daily self-care.

Thailand has not previously conducted a national oral health survey of the disabled population. As Thai adults with disabilities possibly experience poor oral health due to the limitations of oral hygiene self-care, there has not yet been scientific evidence collected regarding this aspect.

This study focused on investigating factors associated with periodontal diseases and oral hygiene status among independent, Thai adults with physical disabilities who were able to perform their own self-care.

2. Methods

A cross-sectional study was conducted between 1st February to 15th March 2018 at the community Center for Independent Living, a disability community club located in Pathum Thani province, Thailand. The data were collected by observing the study participants at the same defined time.

The study protocol was approved by the Research Ethics Review Committee for Research Involving Human Research Participant, Health Sciences Group, Chulalongkorn University, Thailand (No.012/2018). Informed consent was signed.

2.1 Participants

Following a convenient sampling approach, members of disability community clubs (the ‘Don't Drive Drunk Foundation’, the ‘Center for Independent Living’, the ‘Disability Services Center’ and the ‘Community Learning Center’) were invited to participate in the study through an announcement made by the Center of Independent Living, in Pathum Thani province, Thailand. Inclusion criteria were: (1) males and females with physical disabilities, aged 18-64 years, who were identified as having disabilities on their Thai national identity cards; (2) who were living in residential community households; (3) had at least one remaining natural tooth; and (4) had a score of ≥ 12 on the Thai Modified Barthel Activities of Daily Living (ADL) index (more likely independently living) and did not need assistance for grooming (independent self-care for face, hair, teeth and shaving). Exclusion criteria were: (1) persons who had hearing loss, visual impairments, concurrent mental/learning disability or severe somatic and chronic illness or severe periodontitis; or who (2) did not communicate in Thai language; and/or (3) were unwilling to participate.

According to the Thai Ministry of Social Development and Human Security Act B.E.2555, Physical disabilities are referred to people with limitation of activities of daily living or restriction in social participation, due to the explicit physical impairments or disabilities of lower limb(s) or upper limb(s) or both, including physical disabilities that caused by congenital disorders, severe injuries and accidents. A majority of Thai adults with disabilities are physical disabilities.

2.2 Data Collection

Personal information and oral health behavior data were collected as independent variables, using a self-report questionnaire. Participants were interviewed by a trained interviewer prior to the oral examination. The questionnaire was adapted from the standard oral health questionnaire for adults, Thailand Oral Health National Survey 2012. It consisted of two parts: questions on demographic characteristics and on oral health behaviors. Three experts in dental public health validated the contents of the self-report questionnaire by using the index of Item-Objective Congruence, $IOC = 0.87$. A pilot test of 30 participants living within a nearby community, was conducted to test the internal consistency of the questionnaire. The Cronbach's Alpha coefficient was 0.73.

Dependent variables regarding periodontal conditions (bleeding on probing and dental plaque accumulation) were obtained through full-mouth clinical examinations by a trained and calibrated examiner. The minimum kappa value of intra-examiner reliability for oral status assessment was 72%. Individual participants were examined with a portable dental unit. Dental mouth mirror, explorer and periodontal probe were used, based on WHO guidelines (Petersen & Baez, 2013).

Clinical parameters were evaluated using a manual UNC-15 periodontal probe (Hu- Friedy, Chicago, IL, USA).

Primary outcomes were full- mouth bleeding score (FMBS) and full-mouth plaque score (FMPS). Full- mouth bleeding score (FMBS) was recorded the absence or presence of gingival bleeding that occurs within 10-15 seconds from the sulcus was recorded dichotomously, the number of sites with gingival bleeding on probing dividing by the total number of available surfaces, multiplied by 100 (Ainamo & Bay, 1975). Participants with FMBS > 25% were considered to be at “high risk of periodontal diseases” (Lang & Tonetti, 2003). Full-mouth plaque score (FMPS) was calculated on four surfaces per tooth by dividing the number of plaque containing surfaces by the total number of available surfaces, multiplied by 100 (O'Leary, Drake, & Naylor, 1972), FMBS \geq 40% was indicated “poor oral hygiene” (Torrunguang et al., 2005).

2.3 Data Analysis

Data were analyzed by SPSS software (version 22; SPSS, Inc., an IBM Company, Chicago, IL, USA). Fisher's exact test was used to test the association between periodontal conditions and each independent variable; degrees of risk of periodontal diseases (low risk, high risk) and levels of oral hygiene status (good-to-fair and poor) were dichotomized for bivariate and multivariate analyses. Initial univariate logistic regression analyses for identified bivariate comparisons among demographic characteristics, oral health behaviors, and periodontal conditions were performed; associated independent variables with $p < 0.25$ were included in the multivariate logistic regression analysis (Pett, 2016). Associations were presented in prediction models. Predictive potentials of the multivariate logistic regression models were evaluated by percentage of correct predictions. The Hosmer and Lemeshow test was used to evaluate model goodness-of-fit (Valencia et al., 2012). All analyses were two-sided with 95% confidence interval; $p < 0.05$ indicated statistically significant differences.

3. Results

In Table 1, a total of 198 persons with physical disabilities, aged 21–62 years with a mean of 48.5 years, participated in this study. For continuous variables, average score of the Thai Modified Barthel ADL Index was 15.8; participants were generally independent regarding ADL and able to perform self-care rituals involving face, hair, teeth and shaving. Clinical examinations revealed periodontal conditions, FMBS and FMPS were 50.9% and 60.4%, respectively. All continuous variables were non-normally distributed.

For Categorical variables, major demographic characteristics of the study population were age < 50 years (54.5%), male gender (63.6%), wheelchair users (78.8%), educated up to or less than primary school (73.2%), income < \$6,000 per year (76.3%); they were non-smokers (79.8%) who did not consume liquor (89.4%), consumed higher levels of sweets (55.6%), had toothbrushing frequency more than twice per day (59.6%), toothbrushing duration < 2 minutes (52%), used fluoridated toothpaste (74.2%) and did not report regular dental care attendance (77.3%). All participants were UHC beneficiaries (100%). Thus, they are entitled to receive primary dental care services, such as tooth filling, tooth extraction, dental prophylaxis, acrylic dentures and preventive dentistry (Sermsuti-Anuwat & Pongpanich, 2018b).

Table 1. Demographic characteristics and periodontal conditions of study participants (n = 198)

Variables		
Continuous variables	Range	Mean (SD)
Thai Modified Barthel ADL index (score)	12-19	15.8 (2.2)
Age (years)	21-62	48.5 (8.1)
Periodontal conditions		
Full- mouth bleeding score (FMBS) (%)	8-80	50.9 (18.8)
Full-mouth plaque score (FMPS) (%)	25-100	60.4 (20.4)
Categorical variables	Number	%
<50 years	108	54.5
\geq 50 years	90	45.5
Gender		
Female	72	36.4
Male	126	63.6

Wheelchair user		
No	42	21.2
Yes	156	78.8
Education		
>Primary	53	26.8
<= primary	145	73.2
Income/year		
>= \$6000	47	23.7
< \$6000	151	76.3
Current smoker		
No	158	79.8
Yes	40	20.2
Current drinker		
No	177	89.4
Yes	21	10.6
Sweet consumption		
< Once a day	88	44.4
>= Once a day	110	55.6
Fluoridated toothpaste		
Yes	147	74.2
No	51	25.8
Toothbrushing frequency		
>= twice a day	118	59.6
< twice a day	80	40.4
Toothbrushing duration		
>= 2 minutes	95	48.0
< 2 minutes	103	52.0
Regular dental care		
Yes	45	22.7
No	153	77.3
Health insurance (UHC)		
	198	100

Note. ADL= Activities of Daily Living;

SD = Standard deviation;

UHC = Government health insurance (Universal health coverage including dental care benefits).

In Table 2, the association between periodontal conditions and variety of independent variables were analyzed. Toothbrushing frequency was significantly associated with high risk of periodontal diseases ($p < 0.001$) and poor oral hygiene status ($p = 0.001$). Moreover, poor oral hygiene status was strongly associated with sweet consumption ($p = 0.003$).

Table 2. Factors associated with periodontal diseases and oral hygiene status of study participants (n = 198)

Variables	Periodontal diseases		P-value	Oral hygiene status		P-value
	Low risk n (%)	High risk n (%)		Good-to-Fair n (%)	Poor n (%)	
Age						
<50 years	15 (48.4)	93 (55.7)	0.556	22 (51.2)	86 (55.5)	0.730
>=50 years	16 (51.6)	74 (44.3)		21 (48.8)	69 (44.5)	
Gender						
Female	14 (45.2)	58 (34.7)	0.311	21 (48.8)	51 (32.9)	0.073
Male	17 (54.8)	109 (65.3)		22 (51.2)	104 (67.1)	
Wheelchair user						
No	8 (25.8)	34 (20.4)	0.481	10 (23.3)	32 (20.6)	0.679
Yes	23 (74.2)	133 (79.6)		33 (76.7)	123 (79.4)	
Education						
>Primary	9 (29.0)	44 (26.3)	0.826	13 (30.2)	40 (25.8)	0.564
<= primary	22 (71.0)	123 (73.7)		30 (69.8)	115 (74.2)	
Income/year						
>= \$6000	8 (25.8)	39 (23.4)	0.819	11 (25.6)	36 (23.2)	0.840
< \$6000	23 (74.2)	128 (76.6)		32 (74.4)	119 (76.8)	
Current smoker						
No	24 (77.4)	134 (80.2)	0.808	34 (79.1)	124 (80.0)	1
Yes	7 (22.6)	33 (19.8)		9 (20.9)	31 (20.0)	
Current drinker						
No	26 (83.9)	151 (90.4)	0.336	38 (88.4)	139 (89.7)	0.783
Yes	5 (16.1)	16 (9.6)		5 (11.6)	16 (10.3)	
Sweet consumption						
< Once a day	18 (58.1)	70 (41.9)	0.116	28 (65.1)	60 (38.7)	0.003
>= Once a day	13 (41.9)	97 (58.1)		15 (34.9)	95 (61.3)	
Fluoridated toothpaste						
Yes	25 (80.6)	122 (73.1)	0.503	35 (81.4)	112 (72.3)	0.245
No	6 (19.4)	45 (26.9)		8 (18.6)	43 (27.7)	
Toothbrushing frequency						
>= twice a day	28 (90.3)	90 (53.9)	< 0.001	35 (81.4)	83 (53.5)	0.001
< twice a day	3 (9.7)	77 (46.1)		8 (18.6)	72 (46.5)	
Toothbrushing duration						
>= 2 minutes	18 (58.1)	77 (46.1)	0.245	26 (60.5)	69 (44.5)	0.084
< 2 minutes	13 (41.9)	90 (53.9)		17 (39.5)	86 (55.5)	
Regular dental attendance						
Yes	4 (12.9)	41 (24.6)	0.242	5 (11.6)	40 (25.8)	0.063
No	27 (87.1)	126 (75.4)		38 (88.4)	115 (74.2)	

Note. Statistical calculation by fisher's exact test;

n = number.

In Table 3, results of simple bivariate and multivariate logistic regression are presented. A series of bivariate

logistic regressions were performed; regarding high risk of periodontal diseases, there were $p < 2.5$ among participants who consumed sweets more frequently ($p = 0.1$), whose toothbrushing duration was less than 2 minutes ($p = 0.224$) and who had irregular dental visits ($p = 0.164$). There was a strong significant association between participants who brushed their teeth less than twice per day and bleeding on probing occurrence ($p = 0.001$). With regard to poor oral hygiene status, indicated $p < 2.5$ among males ($p = 0.057$), participants who brushed their teeth for < 2 minutes ($p = 0.066$) without fluoridated toothpaste ($p = 0.229$) and those who had irregular dental service attendance ($p = 0.057$). Considerable associations of poor oral hygiene status were observed among participants who had increased sweet consumption ($p = 0.003$) and who brushed their teeth less than twice per day ($p = 0.002$). Then multivariate logistic regression analyses were performed.

For multivariate analyses, in Model A, participants who brushed their teeth less than twice per day were 8.25 times more likely to be exposed to periodontal diseases than participants who brushed their teeth more frequently ($p = 0.001$); in Model B, participants who consumed higher levels of sweetened food and beverages were 3.17 times more likely to show dental plaque accumulation than those who consumed fewer sweets ($p = 0.003$). Furthermore, participants who brushed their teeth less than twice per day were 4.26 times more likely to have dental plaque deposition than those who brushed their teeth more frequently ($p = 0.001$). Chi-squared values for Hosmer-Lemeshow goodness-of-fit tests of Models A and B were 10.35, and 13.45 with significance levels of 0.17 and 0.10. All the significance values were > 0.05 , indicating support for the goodness-of-fit as quoted in a prior study (Hayes et al., 2016). The percentage of cases correctly predicted were 84.3% and 82.8% respectively.

Table 3. Simple bivariate and multivariate binary logistic regression analyses of periodontal conditions (periodontal disease and oral hygiene status) of participants (n = 198)

Variables	Model A Periodontal diseases				Model B Oral hygiene status			
	Crude	P-value	Adjusted	P-value	Crude	P-value *	Adjusted	P-value***
	OR (95%CI)	*	OR (95%CI)	**	OR (95%CI)		OR (95%CI)	
Gender								
Female (Ref)	1				1		1	
Male	1.55 (0.71-3.36)	0.270	N/A		1.95 (0.98-3.86)	0.057	1.96 (0.83-4.64)	0.124
Sweet consumption								
< Once a day (Ref)	1		1		1		1	
≥ Once a day	1.92 (0.88-4.17)	0.100	1.80 (0.79-4.11)	0.163	2.96 (1.46-5.99)	0.003	3.17 (1.46-6.87)	0.003
Fluoridated toothpaste								
Yes (Ref)	1				1		1	
No	1.54 (0.59-3.99)	0.377	N/A		1.68 (0.72-3.91)	0.229	1.57 (0.61-4.06)	0.350
Toothbrushing frequency								
≥ twice a day (Ref)	1		1		1		1	
< twice a day	7.99 (2.34-27.29)	0.001	8.25 (2.39-28.51)	0.001	3.80 (1.65-8.71)	0.002	4.26 (1.75-10.38)	0.001
Toothbrushing duration								
≥ 2 minutes (Ref)	1		1		1		1	
< 2 minutes	1.62 (0.75-3.52)	0.224	1.82 (0.80-4.15)	0.155	1.91 (0.96-3.80)	0.066	1.76 (0.75-4.13)	0.193
Regular dental care								
Yes (Ref)	1		1		1		1	
No	0.46 (0.15-1.38)	0.164	0.41 (0.13-1.31)	0.132	0.38 (0.14-1.03)	0.057	0.35 (0.12-1.02)	0.054

Note. N/A = Variables were not included into the multivariate logistic regression models;

OR = Odds ratio, CI = Confidence interval, Ref = Reference group;

* = P-value for simple bivariate logistic regression;

** = P-value for multivariate binary logistic regression; constant = 1.296;

*** = P-value for multivariate binary logistic regression; constant = 0.358.

4. Discussion

This study provides the first scientific evidence of the factors associated with periodontal diseases and oral hygiene status among adults with physical disabilities in Thailand. The participants were independent, community-dwelling citizens, and therefore were possibly at a higher risk for oral diseases (Horner-Johnson, Dobbertin, & Beilstein-Wedel, 2015).

The majority of participants had high risk of periodontal diseases and poorer oral hygiene status, when compared to the broader Thai middle-aged population without disabilities, according to data from the 2012 Thailand oral health national survey. Although the participants are capable of performing daily self-care, their physical limitation is a possible explanation for difficulty in appropriate personal oral hygiene practices, which can lead to a lower quality of oral cleanliness (El Tantawi & Al Agl, 2017; Jang et al., 2015). These findings are consistent with earlier studies in that they show people with disabilities experience poorer oral health status and irregular oral health behaviors than without disabilities (Chen et al., 2016; Pan et al., 2017; Rashid-Kandvani et al., 2015). The results of this study supported that participants who performed improper oral health behaviors would suffer from high risk of periodontal diseases and poorer oral hygiene status.

Multivariate analyses revealed significant associations between potential oral health behaviors and periodontal conditions (Table 3). A significant association between high risk periodontal diseases and infrequent brushing frequency was demonstrated in Model A. This finding has been consistently reported in prior studies of people with disabilities as the follows: in a study of Saudi Arabia adults with disabilities, toothbrushing twice or more per day resulted in a reduced need for periodontal care (El Tantawi & Al Agl, 2017); among a group of Spanish cognitive impairment and dementia patients, deficiency of toothbrushing was associated with increased dental plaque accumulation and gingival inflammation (Gil-Montoya et al., 2016); finally, among Korean stroke patients, lower frequency of toothbrushing was associated with poor oral health related quality of life and worse periodontal conditions (Jang et al., 2015). A relationship between oral health behaviors and increased dental plaque accumulation was found in Model B. Previous studies also found that a higher frequency of sweets consumption was related to visible dental plaque and that a lack of oral hygiene practices was associated with increased dental plaque aggregation on the cervical margin of the teeth (Gil-Montoya et al., 2016; Pan et al., 2017).

Existing studies suggested that within the disabled community, wheelchair user had a noticeable barrier to accessing dental care services and the challenges could be addresses by well-organized dental care system (Leal Rocha et al., 2015; Rashid-Kandvani et al., 2015). This study additionally focuses on achieving sufficient self-practices of toothbrushing and reducing levels of sweet consumption that are also important for good oral health among persons with physical disabilities.

5. Limitations

Although the results showed significant strengths, there are some limitations in this cross-sectional study, including the inability to investigate causality and the weakness of the self-report method for the oral health behaviors questionnaire. The possible influence of drugs was not observed in this study. Additionally, the majority of adults who participated in this study were disabled due to motor accidents; therefore, they may not be representative of the entire Thai population with physical disabilities. Consequently, further research activities such as large-scale survey research and experimental study on this topic are recommended.

6. Conclusions

This study highlights the need to emphasize the importance of proper oral health behaviors for reducing risk of periodontal diseases and improving oral hygiene status among Thai persons with physical disabilities. Notably, among disabled people who are able to perform their own self-care, a daily oral hygiene routine that is appropriate for their specific needs is an essential solution. Based on the prevalence of bleeding on probing and dental plaque accumulation would be higher among participants who had improper oral health behaviors. Therefore, urgent implementation of personal oral hygiene instruction and oral health education programs, in order to reduce the burden of oral diseases among Thai adults with physical disabilities. Moreover, Thailand health care system should be alerted. Even though all participants in this study rely on the government's universal health coverage scheme, a disproportionate impact of oral diseases persists. Therefore, existing barriers of equitable oral disease prevention and dental care utilization should be clarified and removed.

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Competing Interests Statement

No conflicts of interest have been declared.

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