Original Article

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Effects of using oral hygiene care pamphlets for housebound older persons

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Objective: This study aimed to evaluate the effects of using oral hygiene care pamphlets, in terms of improvement in knowledge and practical skill, decreasing of dental and denture plaque, and the opinions of participants regarding the applicability of the pamphlets, for housebound older persons and caregivers.

Materials and Methods: The pre-test and post-test in follow up study was proceeded at homes in a rural area of Chai Nat province to collect data from 93 housebound older persons who could perform oral care by themselves and 95 caregivers who performed oral care for dependent older persons. The investigation was carried out using questionnaires and oral examination. Oral health knowledge scores, dental and denture plaque scores, oral practice scores were collected at baseline and 4 weeks after pamphlets distribution. Applicability of the pamphlets was assessed by questionnaires. Data were analyzed using descriptive statistics, paired t-test, Wilcoxon signed-rank test, and independent samples t-test. The level of significance was considered at $p<0.05$.

Results: After 4 weeks, the knowledge and practice scores of older persons who could perform oral care were significantly greater than at baseline ($p<0.01$). The dental and denture plaque scores were significantly decreased ($p<0.01$, $p=0.040$, respectively). The results of caregivers conformed to those of the older persons except the denture plaque scores which decreased but not significant. The knowledge improvement of older persons and caregivers were 13.24% and 11.33%, respectively and were less than expectation. Sixty percent of the elders and 90% of caregivers rated the pamphlets suitable to be used in terms of understanding and applicability. Pamphlets with more illustrations should draw the elders' interest.

Conclusion: The pamphlets were effective to improve knowledge and practical skill, and decrease dental plaque of housebound older persons. However, the knowledge improvement did not reach 20% of expectation. It was suggested that the pamphlets alone may not attract the elders' interest and several instruction media should be provided.

Keywords: dependent elders, housebound elders, knowledge, oral hygiene care, pamphlets, practice skill

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Introduction

Currently, the number of older persons aged 60 and over is increasing rapidly all over the world [1], including Thailand [2]. Advances in techniques of dental treatment and dental materials in the past few decades have resulted in success in maintaining natural teeth and increasing the number of dentate elders. Some older persons show adequate oral health. This can be beneficial for the elders as they can have various food intake and good nutrition

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which can bring better health and wellbeing [3]. However, many people experience a variety of oral diseases. The teeth become loose, gums recede as a result of periodontal disease and roots are exposed. Gaps or spaces between teeth and malposition of teeth become manifest due to the effect of tooth loss without teeth replacement. Large proximal and root caries increase in prevalence and severity. Salivary flow may reduce due to some medications. This condition can worsen oral diseases. The daily oral care of those natural teeth will be challenging and more difficult. Impaired vision and reduced manual dexterity can cause daily oral self-care more complicated [4]. The persons who retain natural teeth into old age may find it difficult to manage proper oral hygiene care, especially for dependent elderly persons. Older persons are at greater risk of oral diseases and it can cause more trouble to their overall health. The correlations between oral diseases and general health have been reported, for instance, diabetes mellitus, aspiration pneumonia and cardiovascular diseases. Diabetes is a risk factor for periodontitis and candidiasis. Poor control diabetes is related to more severe periodontal disease and severe periodontitis at baseline is associated with worsening glycemic control over time. Bacteria located in dental plaque may get into the blood circulation after masticatory trauma or dental procedures. Circulating bacteria may adhere to the endothelium of the heart when there is previous damage and initiates intravascular infection. Therefore, oral bacteria may lead to infective endocarditis. In addition, the oropharyngeal microflora, including periodontal bacteria in dental plaque, may be an important cause of respiratory infection, especially in older persons with chewing and swallowing difficulties [5-9]. As some systemic diseases may originate from the oral cavity, it is essential to pay more attention to daily oral care to obtain adequate oral hygiene which means the healthy condition of teeth, gingival tissue, and oral mucosa [10] and to prevent systemic infections and diseases.

In society, most of the older persons live in the community while a small group of them are housebound, or institutionalized. The housebound older persons are defined as the very frail or functionally dependent or partially dependent older persons. They are so physically impaired by chronic illness that they cannot maintain independence. They are also described as persons who are unable to leave their houses without mechanical assistance such as a stretcher or a wheelchair to shop or visit doctors [11]. They are one of the most neglected groups in receiving professional oral care. Unfortunately, oral self-care becomes more difficult due to their compromised manual dexterity and mental conditions. Furthermore, little attention is paid on daily oral care to prevent systemic infections by their family members. Oral care provided by caregivers is placed in a low priority compared to some other tasks [12]. Housebound older persons have a high need of dental care but difficulties in getting to a dentist, ability to pay for dental care and support from a caregiver are barriers to receive dental treatment [13]. As a result, lack of effective plaque removal will worsen oral and dental diseases.

At present, only few oral care guidelines have appeared in public and the contents are inconsistent. To promote oral care for older persons, the development of an effective guideline to provide knowledge and methods of practice in oral care is important. Knowledge on the benefits of good oral hygiene and its management of oral hygiene care may contribute to appropriate oral care practice. Therefore, a group of health personnel has reviewed the published oral hygiene care guideline [14-20], discussed, and come to the conclusion of the current guideline in Thai. This guideline explains the importance of good oral hygiene care, the effective interventions of mouth care for independent and dependent older persons and the roles of caregivers to assist in the oral hygiene care including suggestions of what needs to be

done and how. Before commencing the investigation, the guideline was concluded and reformed into 10 pamphlets so that the content became concise. This type of media is friendly to older persons who are strangers to high technology such as video clips. Moreover, older persons can remember what they have seen much more than what they have only heard from verbal instruction [21-22].

The purpose of this study was to evaluate the effects of using the oral hygiene care pamphlets for housebound older persons. To achieve the aforementioned purpose, this investigation aimed to determine (i) the improvement of oral health knowledge of the elders and caregivers (ii) the improvement of practical skill in teeth and denture cleaning of the elders and caregivers (iii) declining of dental and denture plaque scores of the elders and (iv) the opinions of the elders and caregivers regarding the applicability of the pamphlets.

Materials and methods

Study design and study population

This descriptive, pre-test and post-test in follow up study was a part of the project assessing the effects of using oral hygiene care pamphlets to promote oral hygiene of the elders. The project aimed to investigate the use of pamphlets on different groups of older persons, including independent, housebound and dependent older persons who need help from caregivers. These older persons were different in educational levels, living conditions, cognitive function, and abilities to perform self-care and mobility skills. The participants in the present study consisted of housebound older persons who could perform oral self-care and those who needed help from caregivers. Data from the latter were collected from caregivers except dental and denture plaque scores which were assessed from the elders. The study regarding independent group was not reported here. The term "caregiver" in this study meant the family members of older persons or persons who were employed to assist the daily personal care of older persons and had to be at the age of 18 and over with at least 3-month experience in caring for the elders. The "older persons" meant persons who were at the age of 60 and over.

The inclusion criteria were that housebound older persons who had Barthel Index of Activities of Daily Living (ADL) score 5-11out of 20 and either could or could not perform oral self- care. Lower scores indicated increased disability [23]. If housebound older persons needed help from caregivers for their personal hygiene care, caregivers were assessed the oral health knowledge, practical skill in teeth and denture cleaning and comprehension of the pamphlets. The effectiveness in cleaning was assessed by determining the plaque scores from the elders. The participants had Thai nationality, be able to read Thai and express verbal communication. All participants who were going to answer the questionnaires had a score of cognitive screening test using Thai Mental State Examination (TMSE) ≥ 20/30 [24]. The exclusion criteria were individuals who were unwilling to participate. Older persons who had acute intra-oral lesions such as acute candidiasis, suspected oral cancer lesions and tendency of bleeding disorder were screened to exclude.

Data were collected between May and November 2019 in a rural area at Hankha district, Chai Nat province because of its large population of older persons and housebound elders (19.6% and 3% respectively as compared with 16% and 1.3% of the total Thai elderly population in 2018) The total number of housebound older persons at Hankha district was 277. The estimated sample size was based on the differences and standard deviation of knowledge scores and plaque scores resulted from the previous studies [25, 26] and the sample size obtained from the calculated plaque

scores was chosen due to its higher number. Thus, a sample size of 90 was obtained for each group of the elders who could perform oral self-care and those who need help. Therefore, the number of caregivers (family caregivers and employed caregivers) who help dependent elders perform self-care was 90 as well. The total participants were at least 180. Since the data were collected at the elders' homes for one-month duration, the dropout rate was set at 5%. Thus, 95 participants for each group were recruited in this study. The total sample size of housebound older persons who could perform oral self-care and caregivers was 190. The subjects were selected from the census registration using the cluster sampling method. A 20% of improvement of oral health knowledge scores, practicing skill, and the decrease of dental and denture plaque scores was the assumed result of the intervention.

Data collection

The investigation was carried out using both questionnaires and oral examination. Questionnaires were used to assess the oral health knowledge and applicability of the pamphlets of older persons and caregivers who performed oral care for dependent elders. Such data were not obtained from dependent elders. The oral care practice such as tooth brushing, using of oral hygiene aids and denture cleaning were observed and scored. Oral examination was determined by a dentist to evaluate dental and denture plaque scores of all of the elders at baseline and at 4 weeks after receiving the pamphlets. The study commenced after getting ethical approval from the Faculty of Dentistry / Faculty of Pharmacy, Mahidol University Institutional Review Board. Hankha public health executive and the director of Hankha Hospital were asked for permission to approach the elders for volunteers. The participants were informed of the study briefly. They were also made aware that refusal or withdrawal from the investigation and their opinions regarding the study did not affect the standard of care they would receive in the future. Written consent was obtained from participants or their representatives after they agreed to participate.

Instruments

Oral hygiene care pamphlets

The 10 oral hygiene care pamphlets consisted of the benefits of good oral health and its relation to general health, oral health problems; technique of teeth cleaning and denture cleaning; oral hygiene care for partial dentate and totally edentulous independent older people; oral hygiene care for older people with decreased manual dexterity; oral hygiene care for conscious dependent older people and bedridden older people. The pamphlets were reviewed by three dental faculty members who were not involved in the study to avoid bias. Afterwards, the pamphlets were given to another group of the study population to read and comment so that all contents were clear and understandable.

Questionnaires

Questionnaires regarding the oral health knowledge and the applicability of the oral hygiene pamphlets were used to collect data from older persons and caregivers. Participants' knowledge towards oral health was assessed at baseline and 4 weeks after distribution of pamphlets using twenty items of true/false questions. The questions were previously tested for the validity by three experts in the field of dentistry using Index of Item-Objective Congruence (IOC). The applicability of oral hygiene care pamphlets was assessed using 9 questions e.g. level of understanding of the pamphlets, frequency of practice, level of applicability, time consuming, and appropriateness for using it as guidelines. Recommendation could be suggested by the participants. The questionnaires related to the oral health knowledge and the implementation of oral hygiene pamphlets was pretested by another group of the study population to ensure that all questions were clear and understandable.

Measurements

Plaque score

If the participant presented with natural teeth (full dentate or partial dentate) the plaque index (PI) was assessed using Silness-Löe Index. PI was measured at 4 surfaces around the six indices teeth: 16, 12, 24, 36, 32, and 44. The possible scores for each tooth surface ranged from 0-3. A zero indicated no plaque present, 1 indicated a film of plaque present on the tooth, 2 represented moderate accumulation of soft deposits in the gingival pocket or on the tooth that could be seen by the naked eye and 3 represented an abundance of soft matter within the pocket or on the tooth [27]. An average plaque index score was determined for each individual.

If older participants wore prostheses, the denture plaque was evaluated using the criteria modified from Augsburger *et al.* [28]. Plaque and stain accumulation on polished and tissue surfaces of removable dentures were assessed and scored from 0-4 as follows:

0 = no plaque on both surfaces

1 = light plaque on one surface: 1% - 25% of area covered

2 = light plaque on both surfaces: 1% - 25% of area covered

3 = moderate plaque on polished or tissue surface or both: >25% - 50% of area covered

4 = heavy plaque on polished or tissue surface or both: >50% of area covered

The upper and lower denture plaque scores were used to determine the average value of the denture plaque score of the individual.

The examinations were carried out by a single examiner who was calibrated against a specialist in periodontology before commencing of the study. The Kappa statistics was used to test intra and inter-examiner reliability. The kappa values of dental plaque scores were 0.947 and 0.895 and denture plaque scores were 0.891 and 0.836, respectively, which were considered as high consistency [29]. The data of dental plaque scores and denture plaque scores were recorded. To avoid the examiner's bias during post-test data collection, the data of the pre-test plaque scores were analyzed and kept by another investigator.

Oral hygiene care practice

To evaluate the applicability of the pamphlets, the practical performance of tooth brushing and using other oral hygiene aids such as dental floss, interdental brush, end-tuft brush and gauze were assessed and scored both at baseline and 4 weeks after receiving the pamphlets to obtain pre and post test scores. Tooth brushing was scored by observing the placement of the bristle of the brush at the gum line and movement of the brush in short strokes without skipping area. If the elders were totally edentulous, mouth cleaning including tongue brushing and denture cleaning were evaluated and scored. The examinations and scoring were carried out by a single examiner.

The sequence of the procedures included:

1. The dentist assessed the elders' mouths using a sterile mouth mirror and a probe to evaluate dental plaque score. If the elders wore removable dentures the denture plaque score was assessed and recorded as pre-test plaque score.

2. The participants were asked about the tools they routinely used for cleaning their teeth and performed how to use the tools in their mouths. The scores were recorded as pre-test practicing scores.

3. The participant answered the questionnaire regarding knowledge of oral health and the score was marked and recorded as baseline or pre-test knowledge score.

4. The dentist recommended appropriate oral hygiene aids such as an interdental brush, an end tuft brush and gauzes to the elders and provided to each participant. Instruction of how to use the oral hygiene aids was not explained to the participants. The dentist distributed pamphlets which were suitable for the individual's mouth condition. The participants were asked to read the pamphlets and practice the oral hygiene care according to the guidelines.

5. Four weeks later, the elders were scheduled and the plaque score, practicing, and knowledge post-test score were recorded.

6. Finally, the participants answered the questionnaire related to the applicability of the pamphlets. The ability to understand and applicability of the pamphlets were assessed. The comments were recorded and considered for further improvement of the guidelines.

Statistical analysis

The questionnaire was checked for the completeness, scored for the correct answers, and summarized the score for each part of each individual. The complete data of the participants were managed into a prepared database for analysis. Descriptive statistics was obtained for each variable. Means, standard deviations, and frequency distribution were calculated. The data were processed and analyzed by means of the Statistical Package for the Social Sciences 18.0 (SPSS 18.0, SPSS Inc. Chicago, IL, USA). To evaluate the improvement of oral hygiene level, the difference of the pre-test plaque score and post-test plaque score was determined and percentage of improvement was calculated as follow:

$$\%improvement = \frac{(posttest\ score - pretest\ score)\times 100}{pretest\ score}$$

The pre-test and post-test scores of oral health knowledge and practical skill, dental plaque and denture plaque were analyzed using paired t-test and Wilcoxon signed-rank test. Differences between family and employed caregiver groups were analyzed using independent samples t-test. The level of significance was considered at $p < 0.05$.

Results

Sociodemographic characteristics and oral health status

One hundred and ninety-one housebound older persons were involved in this study. Among these older persons, only 188 persons completed the study. The reason for dropping out of 3 persons was death before post-test data collection. Among 188 older persons, 93 (49.5%) could perform oral self-care and 95 (50.5%) needed help from caregivers. Characteristics of the participants are presented in detail in Table 1 outlining the mean age, gender, educational level, functional status (Barthel ADL), TMSE scores, number of teeth, and wearing of dentures of the participants. The mean age of older persons who could perform oral self-care (Group I) was 77.12 ± 8.02 years (range 60-95 years). The mean age of the elders who needed help from caregivers (Group II) was 80.79 ± 7.84 years (range 60-95 years).

The mean age of 95 caregivers who assisted the elders in Group II was 52.68 ± 12.83 years (range 18-84 years). Sixty-six caregivers (69.5%) were family members and 29 (30.5%) were employed caregivers. The age distribution of the elders in Group I and II and the caregivers are shown in Table 2 and 3. Seventy-one caregivers (74.7%) had experience of elderly care for more than 3 years and 62% spent more than 12 hours per day with the elders.

Thirty-one percent of older persons in Group I and 43% of older persons in Group II were present with more than one systemic disease. Hypertension, diabetes mellitus, dyslipidemia, cardiovascular disease, and chronic kidney disease were common medical problems among the elderly persons in both groups. Disability was also found due to cerebrovascular disease, fall, and rheumatoid arthritis. Older persons in Group I did not have a problem of manual dexterity which allowed them to perform oral care by themselves. Most of the older persons still retained their natural teeth. Table 1 illustrates the number of the remaining teeth of the older persons in Group I and II. The mean numbers of the remaining teeth were 12.5 (range 0-28) and 10.5 (range 0-28) for older persons in Group I and Group II, respectively. Only 31.2% and 24.2% of older persons in Group I

and II, respectively, had ≥ 20 teeth which were considered as a functional threshold. Edentulous mouth was presented in 15 persons (16.1%) of Group I and 31 persons (32.6%) of Group II.

Table 1 Demographic characteristics of the participants

	Older persons Group I	Older persons Group II	Family caregivers	Employed caregivers
No. of participants	93	95	66	29
Mean age (±SD)	77.12 (8.02)	80.79 (7.84)	55.14 (12.96)	47.10 (10.80)
Gender				
Male (%)	31 (33.33)	26 (27.37)	15 (22.73)	3 (10.34)
Female (%)	62 (66.67)	69 (72.63)	51 (77.27)	26 (89.66)
Educational level				
Elementary school (%)	86 (92.47)		46 (69.7)	6 (20.69)
High school (%)	5 (5.38)		14 (21.21)	15 (51.73)
Vocational certificate/diploma (%)	0		2 (3.03)	4 (13.79)
Bachelor's degree (%)	2 (2.15)		3 (4.54)	4 (13.79)
Higher than bachelor's degree (%)	0		1 (1.52)	0
Bathel ADL				
Mean (±SD)	10.33 (1.43)	8.94 (2.26)		
TMSE scores				
Mean (±SD)	24.25 (2.21)		27.05(2.42)	29.03(1.32)
Number of teeth				
Mean (±SD)	12.53 (10.33)	10.46 (10)		
0 (%)	15 (16.1)	31 (32.6)		
1 - 19 (%)	49 (52.7)	41 (43.2)		
≥ 20 (%)	29 (31.2)	23 (24.2)		
Wearing of denture				
Complete denture	9	11		
Partial denture	12	5		

Table 2 Age distribution of older persons in Group I and Group II

Age in year	Older persons Group I %	Older persons Group II %
60 - 69	21.5	10.5
70 - 79	37.6	32.6
80 - 89	34.4	43.2
≥ 90	6.5	13.7

Table 3 Age distribution of the caregivers

Age in year	Family caregivers %	Employed caregivers %
≤ 19	1.52	0
20 - 39	7.57	27.59
40 - 59	53.03	62.07
60 - 79	36.36	10.34
≥ 80	1.52	0

Table 4 and 5 provide a summary of the knowledge scores, practice scores, dental and denture plaque scores of the participants in Group I, Group II (dental and dental plaque scores, only) and the caregivers at baseline and 4 weeks later. The differences of these scores between family caregivers and employed caregivers are shown in Table 6.

Table 4 Comparison of knowledge scores, practice scores, dental plaque scores, denture plaque scores at baseline and after 4 weeks of Group I

Studied scores (full mark)	n	Group I Mean (SD)		P-value
		Baseline	After 4 weeks	
Knowledge scores (20)	93	14.7 (2.08)	16.37 (1.84)	<0.001*
Practice scores (8)	93	2.43 (1.26)	4.9 (1.87)	<0.001*
Dental plaque scores (3)	78	1.86 (0.67)	1.23 (0.74)	<0.001*
Denture plaque scores (4)	21	3.32 (1.09)	2.69 (1.30)	0.040*

Table 5 Comparison of knowledge scores, practice scores, dental plaque scores, denture plaque scores at baseline and after 4 weeks of Group II

Studied scores (full mark)	n	Group II Mean (SD)		P-value
		Baseline	After 4 weeks	
Knowledge scores (20)	95	16 (2.07)	17.61 (1.85)	<0.001*
Practice scores (8)	95	1.72 (1.12)	3.95 (2.38)	<0.001*
Dental plaque scores (3)	64	2.09 (0.72)	1.60 (0.73)	<0.001*
Denture plaque scores (4)	16	3.37 (1.34)	3.00 (1.46)	0.078

Table 6 Difference of scores obtained from relative caregiver and employed caregiver at base line and 4 weeks

	status	n	Mean (SD)		
			Base line	After 4 weeks	Diff
Knowledge scores	relative	66	15.54 (2.12)	17.30 (1.52)	1.75 (2.06)
	employed	29	17.03 (1.52)	18.31 (1.60)	1.27 (1.86)
			P-value		0.284
Practice scores	relative	66	1.74 (1.24)	3.68 (2.36)	1.9 (2.1)
	employed	29	1.68 (1.16)	4.55 (2.36)	2.89 (1.95)
			P-value		0.038*
Dental plaque score	relative	44	2.06 (0.69)	1.59 (0.75)	0.48 (0.59)
	employed	20	2.17 (0.79)	1.64 (0.69)	0.53 (0.59)
			P-value		0.763
Denture plaque score	relative	9	3.33 (1.79)	2.77 (1.48)	0.55 (1.10)
	employed	7	3.42 (1.52)	3.28 (1.49)	0.14 (0.37)
			P-value		0.319

Oral health knowledge

All participants in Group I and caregivers knew that appropriate teeth and oral cleaning could reduce plaque accumulation and prevent tooth decay and gum disease but more than half of them (53.8% of Group I and 51.6% of caregivers) did not aware that dental plaque is only soft deposits on the teeth, not the hard deposits. They believed that gum receding and tooth loss were a consequence of ageing. More than half of the elders (63.4%) thought that dentures should not be removed at night otherwise dentures might become loose and most of them thought that toothpaste should be used for denture cleaning. In addition, they did not know the effects of mouth dryness on their oral health. Table 4 and 5 present the knowledge scores of the elders in Group I and the caregivers. At baseline, the mean knowledge scores of the elders in Group I and the caregivers were 14.7 and 16.0 out of 20 and four weeks after receiving the pamphlets the mean scores were 16.37 and 17.61, respectively. The scores of both groups increased significantly (p<0.001) which were 13.24% improvement in Group I and 11.3% in Group II. Comparing the knowledge scores of the relative caregivers and employed caregivers, there was no statistically significant difference (p = 0.284) (Table 6).

Practical skill in oral hygiene care

At baseline, most of the elders in Group I used hard and flared bristled brushes and brushed in scrubbing method with long strokes that did not reach the gum line and the inner surfaces of the teeth were skipped. Nine older persons (11.5%) did not brush their teeth due to difficulties in reaching the tools that were kept too high and pain from tooth mobility. Only 6.41% of them performed the correct technique of tooth brushing and 3.85% used interdental brush for interproximal cleaning without any other oral hygiene aids. Among the elders in Group II, the caregivers took responsibility for the elders' general hygiene care but oral care was not performed correctly or consistently. Regarding denture cleaning, some of them used toothbrush and toothpaste and some used only tap water. The practice scores of Group I and the caregivers are illustrated in Table 4 and 5, respectively. The elders in Group I and the caregivers could perform oral care better after receiving the pamphlets. The practice scores of both groups increased significantly (p<0.001). Seventy five older persons (80.6%) in Group I had increased practice scores. More than 40% of them had higher scores of tooth brushing and oral soft tissue care and 70% received better scores of using oral hygiene aids especially interdental brush. Only 19% could improve denture cleaning scores. In Group II, 64 caregivers (67.3%) got better practice scores. Approximately 50% of them got a higher score of tooth brushing and using oral hygiene aids, 60% improved oral soft tissue care and only 25% got better scores for denture cleaning. When the practice score of the relative caregivers was compared with the score of the employed caregivers, the latter had a higher score and the difference was statistically significant (p = 0.038) (Table 6).

Dental and denture plaque scores

The elders in Group I had lower dental plaque score than the elders assisted with oral care by caregivers both at baseline and 4 weeks after receiving the pamphlets. However, the dental plaque scores of both groups declined significantly (p<0.001) after 4 weeks. The improvement of the dental plaque scores of Group I and Group II was 31.36% and 22.72%, respectively. Denture plaque scores of both groups declined after 4 weeks but only the differences in Group I was statistically significant (p = 0.040). (Table 4, 5) The improvement of the denture plaque scores of Group I and Group II was 7.77% and 9.6%, respectively. Comparing the dental and denture plaque scores of the elders assisted by relative caregivers and employed caregivers, there was no statistically significant difference (p = 0.763 and 0.319, respectively) (Table 6).

Comprehension and applicability of the pamphlets

Most of the elders in Group I and the caregivers who assisted the elders in Group II (75.2% and 75.8%, respectively) read half to all of the pamphlets. They reported their comprehension as moderate to full understanding of the content (94% of both groups). However, the practice in oral care differed to some extent between the two groups, with those in Group I reporting that they performed oral care according to the instruction every day or nearly every day (69.8%) compared to 42.5% in the group of caregivers. The elders and caregivers rated their ability to perform oral hygiene care as "could perform all or almost all" (80.5% and 89.4%, respectively). Though cleaning somebody else's teeth is not an easy task, 83.9% of the caregivers reported that they received well cooperation from the elders. Limited time and lack of oral hygiene devices was not an obstacle in this study.

Among the participants who read the pamphlets, 60.2% of the elders and 89.7% of the caregivers rated the pamphlets suitable to be used in terms of understanding and applicability. Forty percent of the elders and 10% of the caregivers commented that the font size of the pamphlets was too small. They also suggested that the pamphlets with more illustrations and less content should draw the elders' attention better than lots of information. In addition, 3.6% of the elders and 9.1% of the caregivers suggested video clips as another instructional media.

Discussion

As the numbers of older persons who are unable to leave home or move alone independently are increasing with age, the studied participants in this investigation were housebound older persons. This group of older people, particularly those with chronic disabling conditions, is at risk for poor oral health due to the presence of many risk factors such as multiple medication, mouth dryness, and swallowing problem [16]. Some of them may require support from others with activities of daily living and daily oral care. Relying on other people to maintain oral hygiene may affect their oral health. For this reason, this study included older persons who could perform oral care themselves and dependent older persons who could not maintain self-oral hygiene and needed assistance of oral care from their caregivers. Therefore, the caregivers were included in the study as well. Most of the caregivers were female which is in agreement with the literature [30, 31]. This is probably due to the cultural factor, whereby the functional duty as caring belongs to women. In general, the suggested cut-off point of the TMSE test to determine cognitive impairment is 23 out of 30. According to the study reported by Muangpaisan *et al.* [24], it revealed that age, education, and economic status have an effect on performing the TMSE test. They also suggested choosing the cut-off point less than two SDs below the mean to distinguish normal and impaired cognitive function in older persons with lower education. Hence, this study set the cut-off point at 20 out of 30. Data were collected at the elders' houses. This was beneficial because the authors could reach their living environment, and the conditions that might influence the oral health of older persons. This allowed proper assessment of oral self-care levels and the level of caregiver support available. In addition, at the end of the investigation the elders, relatives and caregivers were more rested at home to receive advice of proper oral care from the authors. In this study, the dropout rate was low (1.57%). Hence, we considered the studied group to be representative of the housebound older persons at Hankha district.

The results of this study revealed that only 75% of the elders and caregivers read half to all of the pamphlets. It was possible that the greater age of the participants with poor eye sights and the

educational level might be the barrier to read much content in the pamphlets. Though the participants reported that they could understand the content, the improvement of the knowledge scores of the elders in Group I and the caregivers in Group II were 13.24% and 11.33% that did not reach the expected value of 20%. Too much content in the pamphlets and declining memory of the aged participants might be the explanation. However, the practice scores of the elders and caregivers increased significantly. Most of the participants preferred interproximal brush to dental floss. Flossing was generally not attempted, and they did not think dental floss as a feasible practice due to their manual dexterity and difficulty in getting it in the elders' mouths by the caregivers. Using interproximal brush was not much different from using a toothpick which they were familiar with. This resulted in improvement of the dental plaque scores of the elders in Group I and Group II (31.36% and 22.72%, respectively), suggesting that the prevalence of proximal and root caries can be reduced in these housebound elders. On the other hand, the denture plaque scores of the elders in Group II before and after receiving the pamphlets were not significantly different. The reasons probably were that their dentures had been used for longer than 10 years and the deposit was dense, sticky plaque and calculus which could not be removed using only liquid soap and toothbrush and the elders were so old and frail that it was difficult to get to a dentist to receive maintenance care. Home visits by professional dental team to provide periodic denture maintenance care or remake a new set might be more appropriate. Inadequate denture cleaning can result in denture plaque and dense layer of microorganisms on denture surfaces which may cause denture stomatitis [32]. Fortunately, this oral lesion was not observed in this group of the elders. Regular maintenance care by dental personnel should be advised or a new set of dentures should be fabricated to enhance healthy soft tissue.

The caregivers in Group II reported that some elders (3.4%) always resisted the oral care and 12.6% occasionally resisted it. The elders' poor behavior, such as physically aggressive manner, non-compliance or lack of participation, with oral care was a significant obstacle that might lead to decreased effort of caregivers to provide oral care [16, 33]. This would be the reason why the caregivers did not perform oral care for the elders consistently. In addition, inconsistent oral care performing might indicate that oral care was not judged as a priority task. Similar result was observed by Cornejo-Ovalle et al. [34] This suggested that the pamphlet regarding the benefits of good oral health and its relation to general health should be improved to increase readers' comprehension of text information and illustrations should be added to aid comprehension and direct attention. To improve caregivers' oral health knowledge and attitudes, oral care training with updating of oral hygiene protocols should be organized by dental personnel periodically [35].

In this study, there was no report of lacking access to needed equipment and products for providing oral care. It was because this study aimed to investigate the effect of using the pamphlets in terms of understanding and applicability, therefore, all equipment was provided. In fact, all needed equipment should be available not only in dental clinics but also in the market so that the elders can have better choices.

The results of this study indicated that the knowledge of the importance of good oral hygiene, the relation of oral health and general health and the instruction of using different equipment for oral care could motivate the participants' interest in performing oral care practices, though the scores in some parts did not reach the expectation. The knowledge positively affected the attitude, and the ability to perform oral hygiene care and help older

persons and caregivers consider the oral cavity worth to care as the rest of the body. Moreover, brushing somebody else's teeth is not a straightforward task and great effort is required. It needs skill that has to be learned [36]. Caregivers need to know and practice how to provide appropriate oral hygiene care for the elders. In this study, most of the employed caregivers had experience of oral care training which would help them increase confidence and competence in providing oral care. Hence, they got higher practice scores.

The questionnaires were formulated to allow the participants to express their opinions freely in part of the applicability of the pamphlets. It seems to be of importance that interest in reading the pamphlets showed differently between individuals. Generally, pamphlets are usually not read by persons with low literacy. However, some participants in this study preferred reading including more illustrations and others preferred video clips. The elders wanted to read the pamphlets with larger font size and clear illustrations while the younger caregivers preferred video clips. Poor eye sights and difficulty in accessing the technology of the elders might be the key points of this comment.

The results of this study indicated that the information in the oral hygiene care pamphlets were effective in improving the knowledge, and practical oral care skill of the housebound older persons and their caregivers. The dental plaque scores of the elders also decreased significantly. However, the improvement of knowledge did not reach the 20% of expectation. The age of this population may be the limitation of this result. Since older persons in Group I and some caregivers of Group II were older adults, age range 60-95 years and 18-84 years respectively, age-related declines in working memory may affect them to process and retrieve information simultaneously during reading the pamphlets [21]. Additionally, the results of this study are in agreement with the study reported by de Baat *et al.* [37]. They reported that written information alone was shown to be an ineffective way of reaching and encouraging elderly people. On the contrary, verbal instruction succeeded in significantly improving knowledge regarding denture hygiene [38]. Therefore, at the end of this current investigation, the elders and caregivers received oral hygiene care advice and demonstration of tooth brushing and using other oral hygiene aids to promote good oral health of the elders and encourage the caregivers in management of non-compliance elders. For further study, after modification of the pamphlets according to the suggestions, the presentation, and demonstration, should be organized to promote oral hygiene care. Afterwards, the oral health status of the elders should be further investigated to assess the actual outcome of the oral care programme. In frail and dependent older persons, the responsibility for oral hygiene care will come to those who care for them. Hence, caregivers need to be trained and learn how to brush somebody else's teeth thoroughly. Preventive strategies and frequent monitoring of oral status by dental personnel would help improve oral health of older persons who retain their natural teeth into old age.

Conclusion

Within the next few years, oral health of older persons will change towards maintaining natural teeth including complicated dental restorations. This would bring benefits of better nutritional status and quality of life, but it could bring a great deal of dental and oral diseases and the need for complicated oral hygiene care as well. Effective plaque removal is very important in controlling oral diseases. The results of this study indicated that there was a significant improvement in oral health knowledge, practical skill in teeth and denture cleaning and declining dental plaque after the elders and caregivers received the pamphlets.

Most of them also agreed that the pamphlets were understandable and suitable to use as the oral hygiene guides. To make the pamphlets more age-friendly, some comments, such as shortening some content, increasing the font size and adding more illustrations, were advised. This study suggested that the pamphlets alone may not be an effective way to attract the interest of oral health care. The educational oral care programme including several instructional media such as written information in the form of pamphlets, verbal instruction, class discussion, demonstration and hands on may be beneficial and help the elders and caregivers increase understanding and have positive attitude to oral care. The educational programme should involve only older persons with well physical health and cognitive function so that they can effectively participate.

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