Effectiveness of the Diabetic and Oral Care Program for Senior in Older Patients with Diabetes in Muang District, Nakhon Ratchasima Province

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Abstract

To assess the effectiveness of how the Diabetic and Oral Care Program for Senior (DOCS) can improve oral health knowledge, behaviors and oral hygiene status in type 2 diabetes mellitus (T2DM) in older patients. Methodology: A randomized controlled trial recruited thirty-five senior patients with diabetes from two health centers between July 2019 and January 2020. The intervention group attended the DOCS program. The control group received the routine program. Outcomes were assessed for the HBM questionnaires, oral health behaviors, oral hygiene index (OHI-S) at baseline, 3-month and 6- month respectively. Data were analyzed using a descriptive statistic, chi-square, independent t-test, repeated measure ANOVA at p-value ≤ 0.05. Result and Discussion: The independent t-test showed significant differences in the HBM scores, oral health behaviors scores, OHI-S between the DOCS group and the control group at 3-month and 6- month ($p<0.05$). Repeated measure ANOVA and Bonferroni post-hoc analysis showed at 6- month in the DOCS group improved statistically significantly from baseline to final visit ($p\leq0.05$) in the HBM scores, oral health behaviors scores, OHI-S. Conclusions: The Diabetic and Oral Care Program for Senior (DOCS) can improve oral health knowledge, behaviors, and oral hygiene.

Keywords: *Oral health intervention, Health belief model, Diabetic, Oral hygiene index, Older people*

1. Introduction

Thailand has nearly become a complete aging society (The National Commission on the Elderly, 2017). Nakhon Ratchasima province also becomes an ageing community because the number of its older population was increasing continuously from 14.8% in 2015 to 19% in 2017 (organization, 2017). Diabetes mellitus (DM) is a global public health problem (Danaei et al, 2011). There are 347 million adults who suffer from type 2 DM (T2DM), corresponding to a global prevalence of about 10% in 2008 and may double in 2030 ("The Economic Costs of Undiagnosed Diabetes," 2009). Prevalence of DM has been increasing among the Thai population from 6.9% in 2009 to 8.8% in 2014 and is highest in the population age 60-69 (16.7%) (Aekpalakarn, 2017). According to Health Data Centre from Ministry of Public Health (HDC program), it was shown that the number of older people with T2DM in Nakhon Ratchasima was rising rapidly from 120,410 patients in 2017 to 129,351 patients in 2019 and is highest in the population over age 60 (The Health Data Center of Thailand, 2019). DM is a chronic systemic metabolic disorder that causes morbidity and mortality due to long-term complication, which affects important organs (American Diabetes Association., 2019). Periodontal disease is the sixth complication of DM. The risk of periodontitis is increased by approximately threefold in DM patients (Preshaw et al, 2012). Periodontal disease and DM have a bidirectional relationship. The effect of DM increases the risk for periodontal disease and periodontal inflammation which also negatively affecting glycemic control (Lamster, Lalla, Borgnakke, & Taylor, 2008). Therefore, it is important to decrease the adverse effects of oral complications on glycemic control in patients with diabetes, especially in diabetic patients with periodontitis, through health promotion or oral health program for prevention and management (Albert et al, 2012). In Muang district of Nakhon Ratchasima, there are many older people with diabetes. There was no prior study on oral health programs in old people with diabetes. Therefore, it is necessary to study such a research.

2. Objectives

To assess the effectiveness of how the Diabetic and Oral Care Program for Senior (DOCS) can improve oral health knowledge, behaviors, oral hygiene in type 2 older patients with diabetes.

3. Materials and Methods

3.1 Subjects

The participants of this study were diabetic patients who have received services at Yangyai and Khok Kruat Health Centers in Muang District of Nakhon Ratchasima Province, Thailand. The sample size was 35 people for each group (Saengtipbovorn & Taneepanichskul, 2014). Diabetic patients with age over 60 years and had at least 10 natural teeth were selected for this study. The patients with serious systemic disease or complications including stroke, severe heart disease, severe neuropathy, end-stage renal failure on haemodialysis and serious mental disorder were excluded. Patients who had manual dexterity problems, depended on the caretaker, deafness, blindness, and unable to communicate in Thai were also excluded. Yangyai and Khok Kruat Health Centers were randomly assigned to the intervention and control groups. Yangyai Health Centre received the intervention while Khok Kruat Health Centre received routine program (control group). Initially, 257 older diabetic patients from Yangyai Health Centre and 253 senior diabetic patients from Khok Kruat Health Centre were selected. Then, in accordance with the inclusion criteria and randomized by simple random sampling technique, 35 patients were selected for both of the intervention and the control group. The research proposal was approved and reviewed by the ethical committee of the Faculty of Dentistry/Faculty of Pharmacy, Mahidol University, Institutional Review Board (No.MU-DT/PY-IRB 2019/042.0307; July 3, 2019).

3.2 Examiner calibration

Standardized interviewers: two interviewers were the health officers who did not work in both health centers. They were blinded to group assignment. The interviewers attended a training program before collecting data. Standardized dentists: two dentists were on the same baseline and did not work in both health centers and measured of both groups. They did not know where were the intervention or the control group take place. Intra-examiner reliability of two dentists by using the Cronbach's coefficient alpha was 0.99 and 0.99, which is an excellent agreement. Inter-examiner reliability between two dentists were tested by using the Cronbach's coefficient alpha was 0.98 which also imply excellent reliability.

3.3 Intervention group

The intervention group received 4 weeks of Diabetic and Oral Care Program for Senior (DOCS) (the DOCS group). During the first week, there was 1-hour oral health education program for diabetic patient by an interdisciplinary team that applied from the Health Belief Model (HBM) (Abraham & Sheeran, 2005) using the slide presentation consisted of the relationship and complications between T2DM and oral health, oral care and diabetic diet. During the second week, there was dental group practice on oral cleaning and self-oral examination by dentist and dental hygienist. During the third week, scaling and root planning were performed by dentists. In the last week, dental hygienist demonstrated individual oral hygiene instruction, including tooth brushing, using an interdental brush, cleaning denture, and how to self-check oral health. After 3 months, an individual oral hygiene instruction was revised to patients again by dentist and dental hygienist.

3.4 Control group

The control group received routine program including an appointment with doctor once a month, blood testing, collecting medicines from the nurse every 3-month and oral examination once a year.

3.5 Outcome measure

Diabetic patients in both groups were interviewed about general characteristics, the HBM questions, oral examination at baseline in 3-month and 6-month follow up period. The double-blind technique was used.

The patients did not know that they were in each group and the interviewers did not know that the patients were in each group. A structured questionnaire consisted of 2 parts as follow; 1) the general characteristics and 2) the HBM and oral health behavior questions. The structured questionnaires were validated by 3 experts in periodontology, community dentistry and, advanced dentistry. The Item-Objective Congruence Index (IOC) was 0.95. A pilot study was proceeded to test the reliability of questionnaires. The Cronbach's coefficient alpha was used to evaluate the questionnaires' reliability. It was divided into parts as follows: 5 parts of Health Belief Model questionnaires and 1 part of the oral health behavior questionnaires. Part 1 Perceived Susceptibility to periodontal disease and poor glycaemic control: the Cronbach's coefficient alpha was 0.73. Part 2 Perceived Severity of periodontal disease and poor glycaemic control: the Cronbach's coefficient alpha was 0.76. Part 3 Perceived benefit to prevent periodontal disease and control glycaemic status: the Cronbach's coefficient alpha was 0.75. Part 4 Perceived barriers to prevent periodontal disease and control glycaemic status: the Cronbach's coefficient alpha was 0.76. Part 5 Perceived self-ability to carry out the recommend action: the Cronbach's coefficient alpha was 0.71. Part 6 Oral health behavior: the Cronbach's coefficient alpha was 0.80. The Cronbach's coefficient alphas of the structure questionnaire were 0.71 – 0.80, indicated that the reliability was good. Oral hygiene examination was done from two calibrated dentists by using simplified oral hygiene index (OHI-S)(Greene & Vermillion, 1964).

3.6 Statistical analysis

Statistical analysis of data was performed using the SPSS software (IBM SPSS statistics version 23; SPSS Inc). Data were analyzed by using descriptive statistics. Frequency distribution and percentage used to describe general characteristics. Mean and standard deviation were used to describe a patient's oral hygiene index, the HBM and oral health behavior scores. Chi-square and independent sample t-tests were used to compare the difference between the two groups at baseline, 3-month and 6-month. Repeated measure ANOVA and Bonferroni post-hoc analysis used to compare the inner-group differences between baseline, 3-month and, 6-month. All analysis used statistically significant at $p\text{-}value \leq 0.05$.

4. Results and Discussion

The study included a total of 70 older diabetic patients commenced from July 2019 till January 2020. There was a 100% response rate, 35 patients in the DOCS group (n=35) and 35 patients in the control group (n=35). The results showed no statistically significant differences at baseline general characteristic of patients between the two groups in terms of age, gender, body mass index, duration of being diabetes, systemic disease, history of smoking, occupational, education level, income and, health insurance Table 1.

Health Belief Model Scores

The Health Belief Model components of perceived susceptibility, perceived severity, perceived barriers, perceived benefit and perceived self-efficacy of both group at baseline, 3- month and, 6- month follow up were shown below in Figure 1.

Perceived Susceptibility

The first component of the HBM was perceived susceptibility. Its mean scores showed that there was no statistically significant differences between the two groups at the baseline (p=0.19). However, there were statistically significant differences between the two groups at 3-month and 6- month follow up. The mean differences were 0.54±0.21, p<0.05 and 0.54±0.22, p<0.05 respectively.

A repeated measure ANOVA (within-subjects) showed statistically significant differences of perceived susceptibility scores within the DOCS group between baseline, 3-month and 6- month follow up; F (1.037, 35.266) = 14.150, p<0.05. Bonferroni post-hoc analysis revealed that the baseline (10.94±1.59) was lower than 3-month and 6-month with statistically significant differences (11.97±0.17, p<0.05 and 11.98±0.16, p<0.05). There showed no statistically significant differences between 3-month and 6-month (p=1). While the patients within the control group showed no statistically significant difference of perceived susceptibility scores within the group between baseline, 3-month and 6-month follow up; F (1.748,59.428) = 0.036, p=0.95.

Table 1 General Characteristic (n=70)

Variable	DOCS group (n = 35) (%)	Control group (n = 35) (%)	*p*-value
Age			
Mean ± SD	65.6 ± 3.9	67.4 ± 4.4	0.08
Min-Max	60 – 74	61 – 75	
Gender			
Male	7 (20.0)	10 (28.6)	0.11
Female	28 (80.0)	25 (71.4)	
Body mass index			
Mean ± SD	24.9 ± 4.1	24.9 ± 3.4	0.97
Min-Max	18.4 – 35.5	19 – 34.4	
Duration of being diabetes			
Mean ± SD	12.6 ± 9.0	12.31 ± 8.8	0.90
Min-Max	1 – 35	1 – 33	
Teeth			
Mean ± SD	18.49 ± 6.41	21.26 ± 8.50	0.13
Min-Max	10 - 32	10 – 32	
Other Systemic diseases			
None	3 (8.6)	12 (34.3)	0.58
Hypertension (HTN)	12 (34.3)	10 (28.6)	
Dyslipidaemia (DLP)	4 (11.4)	2 (5.7)	
HTN + DLP	12 (34.3)	8 (22.9)	
Chronic kidney disease	3 (8.6)	2 (5.7)	
Heart disease	1 (2.9)	1 (2.9)	
Smoking			
Never	30 (85.7)	26 (74.3)	0.24
Ever	5 (14.3)	9 (25.7)	
Current smoker	0 (0)	0 (0)	
Occupational			
Work	8 (22.9)	10 (28.6)	0.25
Non-working	27 (77.1)	25 (71.4)	
Educational level			
Primary school	33 (94.3)	29 (82.9)	0.14
Secondary school	2 (5.7)	6 (17.1)	
Income			
< 5,000 baht	24 (68.6)	18 (51.4)	0.29
- 5,000 – 10,000 baht	5 (14.3)	10 (28.6)	
- > 10,000 baht	6 (17.1)	7 (20)	
Health insurance			
Universal coverage	32 (91.4)	31 (88.6)	0.70
Government	3 (8.6)	4 (11.4)	

p-value comparing between the two groups using chi-square, independent t-test
($p \leq 0.05$ – statistically significant)

Perceived severity

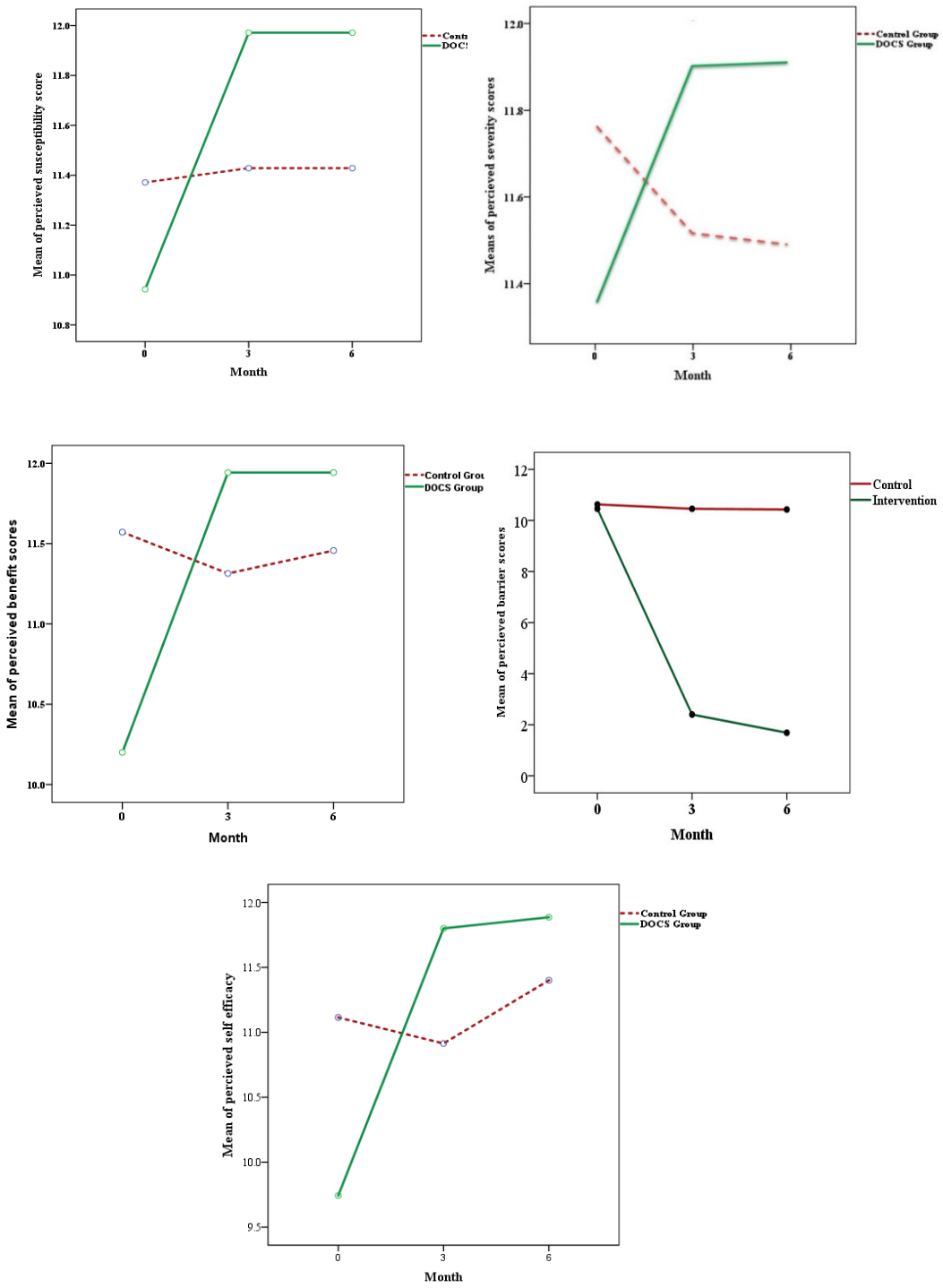

Figure 1 Comparison of the health belief model scores between the DOCS and the control group

As for perceived severity mean scores, there was no statistically significant difference between the two groups at baseline (p=0.33). There were statistically significant differences between the two groups at 3-month and 6-month follow up, the mean differences were 0.51±0.19, p<0.05 and 0.09±0.08, p<0.05, respectively. A repeated measure ANOVA (within-subjects) showed statistically significant differences of perceived severity scores within the DOCS group between baseline, 3-month and 6-month follow up; F (1.129,38.385) = 10.590, p<0.05. Bonferroni post-hoc analysis revealed that the baseline (11.31±1.13) was lower than 3-month and 6-month with statistically significant differences (11.93±0.36, p<0.05 and 11.94±0.34, p<0.05). Whereas there was no statistically significant difference between 3-month and 6-month (p=0.97). The patients within the control group showed no statistically significant differences of Perceived severity scores within the group between baseline, 3-month and 6-month follow up period; F (1.361,46.277) = 2.454, p=0.11.

Perceived benefit

As for perceived benefit mean scores, there was no statistically significant difference between the two groups at baseline (p=0.33). However, there were statistically significant differences between the two groups at 3-month and 6-month follow up, the mean differences were 0.63±0.27, p<0.05 and 0.49±0.21, p<0.05, respectively. A repeated measure ANOVA (within-subjects) showed statistically significant differences of perceived benefit scores within the DOCS group between baseline, 3-month and 6-month follow up; F (1.099,37.354) = 55.881, p<0.05. Bonferroni post-hoc analysis revealed that the baseline (10.20±1.32) was lower than 3-month and 6-month with statistically significant differences (11.94±0.24, p<0.05 and 11.95±0.20, p<0.05). There was no statistically significant difference between 3-month and 6-month (p=1.00). While, the patients within the control group showed no statistically significant differences of perceived benefits scores within group between baseline, 3-month and 6-month follow up; F (1.704,57.933) = 0.374, p=0.66.

Perceived barriers

As for perceived barriers mean scores, there was no statistically significant difference between the two groups at baseline (p=0.50). However, there showed a statistically significant difference between the two groups at 3-month and 6-month follow-ups. The mean differences were 8.06±0.38, p<0.001 and 8.74±0.34, p<0.001, respectively. A repeated measure ANOVA (within-subjects) showed statistically significant differences of perceived barriers scores within the DOCS group between baseline, 3-month and 6-month follow-ups: F (1.293,43.976) = 50.185, p<0.001. Bonferroni post-hoc analysis revealed that the baseline (10.46±0.18) was higher than 3-month and 6-month follow-ups with statistically significant differences (2.40±0.35, p<0.001 and 1.69±0.25, p<0.001). There was no statistically significant difference recorded between 3-month and 6-month follow-ups (p=0.29). While, the patients within the control group showed no statistically significant difference of perceived barriers scores within-group between baseline, 3- month and 6-month follow-ups: F (1.248,42.436) = 41.845, p=0.06.

Perceived self-efficacy

The last component was perceived self-efficacy mean scores. There was no statistically significant difference between the two groups at baseline (p=0.06). There were statistically significant differences between the two groups at 3-month and 6-month follow up, the mean differences were 0.89±0.31, p<0.05 and 0.49±0.21, p<0.05, respectively. A repeated measure ANOVA (within-subjects) showed a statistically significant difference of perceived self-efficacy scores within the DOCS group between baseline, 3- month and 6- month follow up; F (1.285,43.673) = 61.486, p<0.05. Bonferroni post-hoc analysis revealed that the baseline (9.74±1.42) was lower than 3-month and 6-month with statistically significant differences (11.80±0.47, p<0.05 and 11.89±0.40, p<0.05). Whereas there was no statistically significant difference between 3- month and 6- month (p=1.00), the patients within the control group showed no statistically significant difference of perceived self-efficacy within the group between baseline, 3- and 6- month.

Oral health behavior scores

At baseline, there was no statistically significant difference in oral health behavior scores between the two group (p=0.07). The oral health behavior scores between the two groups were found statistically significant differences at 3-month and 6-month follow up (p<0.05, and p<0.05). The mean difference was highest (3.94±0.45) at 6-month with statistically significant differences Figure 2. A repeated measure ANOVA (within-subjects) showed statistically significant differences of oral health behavior scores within the DOCS group between baseline, 3-month and 6-month follow up; F (1.254, 42.652) = 59.398, p<0.05. Bonferroni post-hoc analysis revealed that the baseline (18.43±3.37) was lowest with a statistically significant difference (p<0.05). While, the patients within the control group were no statistically significant differences of oral health behavior scores within group between baseline, 3- month and 6- month follow up; F (1.957, 66.529) = 3.277, p=0.08 Figure 2.

Oral hygiene status

Comparing oral hygiene status between the two groups, there was no statistically significant difference in the mean OHI-S at baseline (p=0.56). The mean difference of OHI-S was highest (2.53±0.14) at 6-months with statistically significant differences at 3-month and 6-month follow up (p<0.05, and p<0.05) Figure 2. A repeated measure ANOVA (within-subjects) demonstrated statistically significant differences of OHI-S within the DOCS group between baseline, 3- month and 6- month follow up; F (2.000, 68.000) =1.763, p<0.05. Bonferroni post-hoc analysis revealed that the baseline (3.31±1.04) was higher than 3-month and 6-month with statistically significant differences (0.88±0.46, p<0.05 and 0.68±0.53, p<0.05). Whereas there was no statistically significant difference between 3-month and 6- month (p=0.09). Not to mention that there was no statistically significant difference of OHI-S within the control group between baseline, 3- month and 6- month follow up; F (1.349,45.867) = 167.395, p=0.18 Figure 2.

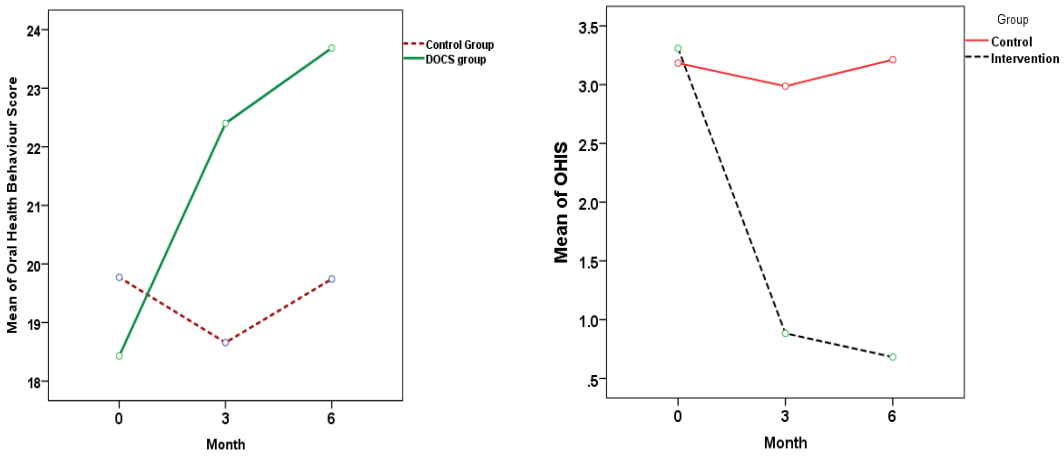

Figure 2 Comparison of oral health behaviour score, OHI-S between the DOCS and the control group

The results of this study illustrated that the DOCS program improved oral health knowledge, behavior and hygiene of older diabetic patients.

After finishing the program of oral hygiene status, including OHI-S in the intervention group, there was a reduction in statistically significant differences after finishing the DOCS program when compare to the control group (p<0.05). Previous researches showed similar results that nonsurgical periodontal therapy and oral hygiene instruction on T2DM subjects with chronic periodontitis can reduce plaque index more than 80% within 3 months significant difference (Raman, Taiyeb-Ali, Chan, Chinna, & Vaithilingam, 2014). The intensive oral hygiene care on periodontitis in T2DM patients can reduce plaque index at 6 months significant differences (p≤0.001) (Lee et al, 2009). The oral health instruction of periodontitis patients with T2DM was

also significantly reduced plaque index and decreased HbA1c by 0.2% within 6-months, although the difference was not statistically significant (Toda et al, 2019).

Previous studies of knowledge, behavior and attitude toward T2DM and oral health have found scores increased after the conclusion of the intervention (Saengtipbovorn & Taneepanichskul, 2014). Whereas, the Education package in T2DM patients was not statistically significant differences in knowledge scores between the two groups after one month (p=0.08) (Tarahomi, 2012). The strengths of this study are 100% response rate, double-blind randomized controlled trial technique and, used biomarkers to examine outcomes. One of the limitations of this study is time constraint. We recommend researchers to incorporate a longer follow up period in the future. Nevertheless, the oral health care program had effects that could be used in routine work by healthcare workers in other health centers.

5. Conclusion

The DOCS program can improve knowledge, behaviors, oral hygiene among older diabetic patients within 3-month to 6-month. Controlling, monitoring and following-up during the program are recommended.

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