Original Article

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Effects of using oral hygiene care pamphlets on functionally independent older persons

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The objective of this study was to evaluate the effectiveness of oral hygiene care pamphlets to improve oral health knowledge, oral health skill and oral hygiene of functionally independent older persons. This study collected the data by using questionnaires and oral examination from functionally independent older persons at the Periodontics and Oral Medicine Clinic, Maha Chakri Sirindhorn Dental Hospital. Questionnaires were used to interview and assess the participant demographic characteristics, oral health knowledge and oral health skill. Oral examination was determined by a dentist to evaluate plaque index (PI) and denture plaque scores. The questionnaires and oral examination collected at baseline and 1 month after receiving the pamphlets. The result from this study shown that one-hundred and twenty functionally independent older persons enrolled in this study. Fifty-one participants (42.5%) were male, sixty-nine participants (57.5%) were female, with an average age of 65.98 ± 5.62 years. At one month after using the oral hygiene care pamphlets, the results showed that the mean scores of knowledge and oral health skill significantly increased when compared to the scores at baseline. PI and denture plaque score significantly decreased at one month after using the oral hygiene care pamphlets ($p < 0.05$). In conclusion, the oral health care knowledge, oral health skill, PI and denture plaque score of functionally independent older persons were significantly improved after using the oral hygiene care pamphlets in one month. Thus, this oral hygiene care pamphlet has an effectiveness to improve oral health knowledge, oral health skill and oral hygiene for functionally independent older persons.

Keywords: older persons, oral hygiene, oral health knowledge, pamphlets, questionnaire.

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Introduction

As a result of decreased fertility and increased life expectancy, the global population aged 65 years or over were 703 million in 2019 and projected to 1.5 billion in 2050 [1]. In Thailand, the older persons will increase continuously and become higher than any other countries in the

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South East Asia region [2]. Then the population of aging and the well-being of older persons are major emerging challenges for families, communities and government.

Decreasing in functional capacity of older persons, age-related changes, chronic diseases, and side effect of drug use that involve with the basic functions of older person's everyday life [3, 4]. Oral health is a reflection of one's general health, affecting the ability of an individual to eat and speak, and contributes significantly to a sense of confidence and well-being [5]. Therefore, maintenance of good oral health means maintenance of good quality of life [6]. Advances in oral health care in the past few decades have resulted in less edentulous people and increasing number of dentate older persons. The complexity of oral health status such as tooth mobility, gingival recession as a result from periodontal diseases, large and sophisticated restorations and prostheses creates an increasing need for oral hygiene care.

Furthermore, decreased muscle tone in older persons, facial paralysis and loss of sensation can cause food debris to accumulate. Impaired swallowing may increase the time for food to contacts the teeth. Dry mouth is the common oral side effect of many medications, which further increases the risk of caries, periodontal disease and oral infection. As many older persons have muscle weakness due to some systemic diseases such as cerebrovascular accident and arthritis, this may influence the older persons' ability of self-caring for oral and denture hygiene [7]. The presence of systemic disease not only influences the patient's ability to maintain oral hygiene but can actually be related to the occurrence of certain oral diseases [8]. Poor oral hygiene can cause plaque accumulation on teeth and prostheses and contributes to aspiration pneumonia, infective endocarditis and other serious systemic diseases such as cardiovascular/ cerebrovascular disease and diabetes mellitus [9, 10]. Thus, poor oral health may have an impact on older persons both physically and psychologically.

Oral health status declines with age and as a result, the need for removable prostheses increases. Denture plaque and poor denture hygiene is associated with stomatitis, and may serve as reservoir of potentially infectious pathogens, which contribute to oral malodour, caries and periodontitis. Oral bacteria have been implicated in bacterial endocarditis, aspiration pneumonia, gastrointestinal infection and chronic obstructive pulmonary disease. An effective oral hygiene regimen is important to control denture plaque biofilm and contributes to the control of associated oral and systemic diseases [5].

When comparing dependent and independent older persons, they had different functional abilities, which affected the quality of life therefore the functional status and the cognitive function of the older persons should be assessed. There are many tools for evaluate the physical function of older persons such as Barthel Index for Activities of Daily Living (ADL) [11], Instrumental Activities of Daily Living (IADLs) [12], the Elderly Mobility Scale [13] and Performance-Oriented Mobility Assessment [14]. This study selected Barthel Index for Activities of Daily Living (ADL) evaluation because this tool was comprehensive and easy to understand. There are various tools for evaluate the cognitive function of the older persons such as Dementia Screening Indicator [15], Geriatric Depression Scale [16], The mini-mental state examination (MMSE) [17] and Thai Mental State Examination (TMSE). TMSE was developed from the committee of the Faculty of Medicine, Siriraj

Hospital [18]. This study selected TMSE because this tool had been modified from MMSE, easy to use, reliable and in Thai [19].

Many authors have suggested oral hygiene care program, protocol and guideline to achieve acceptable oral hygiene of the older person [20-23]. However, those are in English, which are difficult to understand by Thai older persons. Nowadays the oral hygiene care guideline or oral hygiene care pamphlet in Thai is insufficient. And the content is incomprehensive for both dependent and independent older persons.

Recently, the regulations and protocols of oral hygiene care have been developed in Mahidol University by physician, dentists and nurse involved in geriatric patients to promote adequate oral hygiene of both functionally independent and dependent older adults. The purpose of protocol are to (i) emphasize the importance of oral hygiene care (ii) assist the caring staffs in providing appropriate oral hygiene care for functionally independent and dependent older adults (iii) provide guidance for all health professionals on oral hygiene care to improve oral health and oral health-related quality of life of the elders. Before implementation of oral hygiene care protocol to promote oral health of older persons, the content of the protocol should be explored for improvement of knowledge, applicability and the efficiency in improving oral hygiene. The content of the oral hygiene protocol was summarized and divided into 10 pamphlets to make it shorter and easier to understand. In this study we evaluated the pamphlets number 1 to number 7. The content of the pamphlets number 1 to number 7 consist of 1) oral health and older health 2) oral problem in the older persons 3) dry mouth and xerostomia 4) tooth cleaning 5) removable denture cleaning 6) oral health care for independent older adults with remaining teeth and 7) oral health care for independent older adults with removable denture. The detail in the pamphlets number 1 to number 7 suitable for functionally independent older persons which could understandable and practice by themselves.

Thus, the aim of this study was to evaluate the effectiveness of oral hygiene care pamphlets to improve the oral health knowledge, oral health skill and oral hygiene of functionally independent older persons after receiving the oral hygiene care pamphlets.

Materials and methods

Study design and participants

This descriptive and cross-sectional study was carried out at the Periodontics and Oral Medicine Clinic, Maha Chakri Sirindhorn Dental Hospital, Golden Jubilee Medical Center, Mahidol University, Thailand in 2019 on functionally independent older persons. Research data were gathered at baseline and one month after starting the research. Ethical approval for the study was obtained from the Faculty of Dentistry/ the Faculty of Phamacy, Mahidol University, Institutional Review Board (COA.No.MU-DT/PYIRB 2019/014.1903).

Prior to the study, sample size was calculated according to the standard deviation of PI obtained from a previous study [24]. At a 2-sided type I error of 0.01, 90% power of detection, a sample of 93 participants was required. To compensate for 30% potential dropouts, at least 120 participants were recruited for this study. The inclusion criteria were Thai functionally independent older persons with aged 60 years old or over (got ≥ 12 points from ADL and got ≥ 20 points from TMSE tested)

were able to read Thai and express verbal communication and presented with natural teeth and wear or unwear prostheses. Participants who had mental illness, could not read and understand Thai language were excluded.

Oral hygiene care protocols

The oral hygiene care protocols for functionally independent older persons developed in Mahidol University by the physician, dentists and nurses who involved in geriatric patients were categorized into 10 pamphlets including the knowledge of good oral health and its relation to general health, oral health problem and technique for oral hygiene care. The protocols were subjected to repeat reviewing by three faculty colleagues who were not involved in the study to minimize error. Subsequently, the pamphlets were read by another group of the study population to ensure that all contents were clear and understandable.

Interventions

At baseline, all participants were informed about the intervention and had the ADL and TMSE tested. Subjects who met the inclusion criteria and decided to enroll the study had to sign the informed consent. PI and denture plaque score were recorded completely before the participants started answer the questionnaire. If participants had a removable denture, the denture plaque score will record. Oral health skill tests consisted of oral hygiene cleaning aids selection and evaluation the participant's tooth brushing and interdental cleaning skill. Questionnaire for evaluation of oral health care knowledge were explained to the participants before answer the questionnaire. One of the researchers was always available during the participant answer the questionnaire.

The score was recorded as baseline score. After the participants completed the questionnaire, the researcher suggested and gave the appropriated oral hygiene aids for each participant. The participants received the oral hygiene care pamphlets to read and practice at home for 1 month.

After 1 month, PI and denture plaque score were recorded. Questionnaire for evaluation of oral health care knowledge were shuffle question order before give to the participants. The participants finished the oral health skill tests and the questionnaire, and the scores recorded as one-month score. The comments from the participants were considered for further improvement of the oral hygiene pamphlets.

Data collection

PI and denture plaque score

PI were measured at 4 surfaces around each tooth (distal, facial or buccal, mesial, and lingual) on six indices teeth: 16, 12, 24, 36, 32, 44. Four different scores were possible. 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; 3 represented an abundance of soft matter within the pocket or on the tooth [25].

The denture plaque score was evaluated by using the criteria modified from Augsburger et al. [26]. Plaque and stain accumulations were recorded from polished surface and basal tissue contact surface of denture. The score was recorded 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

Oral health skill tests/Oral hygiene care practice

The oral health skill tests were evaluated and scored at baseline and 1 month after receiving the pamphlets. Oral health skill tests were divided into 2 parts. Part 1 test of participant's selection of oral hygiene cleaning aids including selection the toothbrush and selection of the interdental cleaning aid. Part 2 test of participant's brushing method and interdental cleaning skill.

Questionnaires

The questionnaires were used to collect data from each participant at baseline and 1 month after receiving the oral hygiene care pamphlets.

At baseline, the questionnaire was divided into 2 parts. The first part contained general information of the participants including age, gender, nationality, level of education and functional ability to clean the natural teeth and/or prostheses. The second part contained true/false questions related to participant's knowledge towards oral health.

At 1 month after receiving the oral hygiene care pamphlets, the questionnaire was divided into 2 parts. The first part evaluated the understanding, applicability and effectiveness of the oral hygiene care pamphlets. The second part contained true/false questions related to participant's knowledge towards oral health.

Statistical Analysis

The answers of the questionnaires were summarized for each part. Descriptive analysis was obtained data from each variable for implementation of oral hygiene care pamphlets. Means, standard deviations and frequency distribution were calculated. Statistical analysis was performed using a statistical software package for the Social Sciences 18.0 (SPSS 18.0, SPSS Inc. Chicago, IL, USA). Kolmogorov-Smirnov test was used for normality test and data analysis were parametric statistics. Paired T-test was used to compare the difference of knowledge between baseline and one month after using the oral hygiene care pamphlets. PI and denture plaque score were calculated for means and standard deviations. McNemar test was used to compare the different of PI and denture plaque score between baseline and one month after using the oral hygiene care pamphlets. The level of significance was considered at $p < 0.05$.

Results

One hundred and twenty functionally independent older persons who passed the test of TMSE and ADL were willing to participate in this study. Fifty-one (42.5%) were males and 69 (57.5%) were females. Participants were between 60 and 85 years and the mean age was 65.98 ± 5.62 years. Most participants (46.7%) received bachelor's degree. The detail of gender, age, educational level of participants are shown in Table 1.

Table 1 Distribution of socio-demographic characteristics among participants (n = 120)

	n (%)
Gender	
Male	51 (42.5)
Female	69 (57.5)
Age (Years): Mean ± SD	65.98 ± 5.62 (60-85)
Educational level	
Primary school	16 (13.3)
High school/lower	17 (14.2)
Vocational certificate	5 (4.2)
Bachelor degree	56 (46.7)
Postgraduate	26 (21.7)

The comparative evaluation of the knowledge tests, oral health skill tests, PI and denture plaque score at the baseline and at 1 month after using the oral hygiene care pamphlets are shown in Table 2. At 1 month after using the oral hygiene care pamphlets, the mean knowledge score and oral health skill were increased significantly different when compared with baseline ($p < 0.001$). At baseline, most of the subjects exhibited poor oral hygiene and poor denture care. PI was 1.27±0.49 and denture plaque score was 1.70±0.68. At 1 month after using the oral hygiene care pamphlets, PI and denture plaque score were significantly decreased when compared to baseline ($p < 0.001$, Table 2).

The descriptive distribution of the questionnaire for evaluating the understandable and applicable of the oral hygiene care pamphlets are shown in Tables 3 and 4. Ninety-eight participants (81.7%) read all content followed by reading some content but two participants (1.7%) did not read oral hygiene care pamphlets. Forty-eight participants (40.7%) understood almost all content followed by moderate understanding (33.1%) and only one participant (0.8%) did not understand oral hygiene care pamphlets. Fifty participants could follow almost all of the guideline but no participant could not follow the guideline (Table 3).

Seventy-nine participants (66.9%) practiced everyday or almost everyday follow the instructions in oral hygiene care pamphlet and eight participants (6.8%) did not practice follow the guideline (in oral hygiene care pamphlets). Seventy-six participants (69.1%) slightly adapted the practice to suit their own oral condition and sixteen participants (14.5%) were need to adapt the practice a lot to suit their oral condition. One hundred and eleven participants (94.1%) had enough time to comply with the guideline but only seven participants (5.9%) had to hurry to do it because there are other responsibilities to do. However, all participants had time to practice comply with the guideline. Seventy-eight participants (66.1%) thought that pamphlets appropriated to use with slightly editing and forty participants (33.9%) thought that pamphlets appropriated to use without editing. But no participant thought the pamphlets was inappropriate for using (Table 4).

The distribution of suggestions for pamphlet improvement are shown in Table 5. Fifty eight participants (42.03%) thought that pamphlet was not interesting. Twenty-six participants (18.84%) thought that pamphlet had no illustration make it difficult to understand. This study provided oral hygiene aids for all participants then all participants found all recommended devices.

The additional suggestion from the participants was that participants preferred reading oral hygiene care pamphlets (40%) as well as watching clips (40%) more than reading books (20%). Other suggestions were participants need clear contents, step-by-step illustration and attractive color images including the language should be adjusted to be easier to understand and should not have too duplicated contents.

Table 2 Comparative evaluation of knowledge tests, oral health skill tests, PI and denture plaque score between baseline and 1 month after using the oral hygiene care pamphlets

	n	Baseline Mean ± SD	1st month Mean ± SD	*p-value*
Knowledges tests (Full score= 20 points)	120	16.53±1.62	19.19±0.94	$p < 0.001$*
Oral health skill tests (Full score= 8 points)	120	2.77±1.69	7.59±0.86	$p < 0.001$*
PI	120	1.27±0.49	0.15±0.26	$p < 0.001$*
Denture plaque score	36	1.70±0.68	0.40±0.44	$p < 0.001$*

* significantly different when compared with baseline

Table 3 Response distribution of functionally independent older persons to questionnaire for evaluating the using and understandable of the oral hygiene care pamphlets

Questions	Total n (%)	None n (%)	A little n (%)	Moderate n (%)	Almost all n (%)	All n (%)
Did you read the oral hygiene care pamphlets?	120 (100)	2 (1.7)	11 (9.2)	5 (4.2)	4 (3.3)	98 (81.7)
How much did you understand the guideline in oral hygiene care pamphlets?	118 (100)	1 (0.8)	7 (5.9)	39 (33.1)	48 (40.7)	23 (19.5)
Did you can do follow the guideline in oral hygiene care pamphlets?	110 (100)	0 (0)	4 (3.6)	24 (21.8)	50 (45.5)	32 (29.1)

Table 4 Response distribution of functionally independent older persons to questionnaire for evaluating the applicable of the oral hygiene care pamphlets

Questions	Total n (%)	None n (%)	Slightly n (%)	A lot n (%)
How often did you practice follow the instructions in oral hygiene care pamphlets?	118 (100)	8 (6.8)	31 (26.3)	79 (66.9)
How much did you adapt the practice to suit your own oral condition?	110 (100)	18 (16.4)	76 (69.1)	16 (14.5)
Did you have enough time to comply with the guideline?	118 (100)	0 (0)	7 (5.9)	111 (94.1)
Did you think the guideline in this oral hygiene care pamphlets that you received suitable for practice?	118 (100)	0 (0)	78 (66.1)	40 (33.9)

Table 5 The distribution of suggestions for pamphlet improvement (Can answer more than one topic)

Topics	n (%)
Language is difficult to understand	19 (13.76)
Letters are too small to read	17 (12.33)
No illustration makes it difficult to understand	26 (18.84)
Explanation of the practice is not clear.	12 (8.7)
Unable to find all recommended devices	0 (0)
The condition of the teeth is not conducive to use the tools to clean such as mobility, cracking, fracture	6 (4.34)
Pamphlet is not interesting	58 (42.03)

Discussion

The results from this study indicated that the mean of knowledge score and oral health skill score after receiving oral hygiene care pamphlets for one month significantly increased as compared with baseline. It revealed that the oral hygiene care pamphlets significantly improved the oral health care capability of this group of functionally independent older persons. The evaluation of PI and denture plaque score demonstrated that the plaque control in both natural teeth and dentures of functionally independent older persons had been significantly improved after using the oral hygiene care pamphlets. The result indicated that the pamphlets could improve the efficiency of oral hygiene of functionally independent older persons.

Eighty-five percent of the participants read almost all to all content of the pamphlets. The mean score of oral health skill tests was almost full at 1 month after using the oral hygiene care pamphlets. Sixty-seven percent of participants practiced follow the instructions in oral hygiene care pamphlets everyday. Ninety-four percent of participants have enough time to comply with guideline that affected to evaluation of PI and denture plaque score were significantly decreased after 1 month. This result indicated that the participants were interested in oral health care and practiced it regularly.

In this study, at baseline the knowledge of participants in oral health, oral health problem and technique for oral hygiene care were quite good. The knowledge scores at baseline were quite high, but the results in one month also significantly improvement. These results were liked the studies conducted by Keyong *et al.* [22], Little *et al.* [27] and Marino *et al.* [28].

Keyong et al. evaluated the effectiveness of an oral health promotion program base on Health Belief Model (HBM) theory versus traditional oral health activity in the older persons in Khiri Mat, Thailand. The result showed that the experimental group, the plaque index score and gingival index score had significantly decreased after intervention and were lower than the control group, reflecting that the experimental group had a better brushing skill [22]. Little *et al.* assessed the effect of a group-based behavior modification intervention on oral hygiene skills, adherence and clinical outcomes for older

periodontal patients. The result showed that significant improvements in the intervention group versus the usual periodontal maintenance group for oral hygiene skills and self-reported flossing, plaque score, gingival bleeding and bleeding on probing. Then, group oral health intervention provides an effective for helping patients improve their self-care skills and achieve high levels of adherence to an effective self-care regimen [27]. Marino et al. evaluated the impact of a community-based oral health promotion program in the topic of the use of oral health services, oral health knowledge, attitudes, and practices in Greek and Italian older persons. The intervention consisted of oral health seminars among the older persons, the provision of oral health care products and the production of oral health information sheets. They found that experimental groups were significantly improved oral health attitudes, oral health knowledge, self-assessed physical health status and self-reported oral hygiene practices [28].

The results of this study might differ from the previous studies. Because other studies used various interventions such as group oral health intervention [27] and oral health care program [20, 22, 23, 25, 28-30] while this study only gave the pamphlets to participants for reading by themselves and gave the appropriated oral hygiene aids for each participant without teaching.

PI and denture plaque score were significantly decreased when compared to baseline. The improvement of PI and denture plaque score from this study reflected the effectiveness of oral hygiene care pamphlets and gain in oral health skill may improve oral health. The interrelationship between oral health and general health is particularly pronounced among older people [31]. Poor oral health can increase the risks to general health [32], thus good oral hygiene will result in good oral health and good general health [33, 34].

The limitations of this study were diversity of participants. Fifty percent of participants had a high education level thus the participants in this study had a good basic knowledge of oral health as shown in baseline knowledge score was 16.53 from 20 points and only 1 participant reported that he/she could not understand the content of oral hygiene care pamphlets. However, when compared to the knowledge score at 1 month after receiving the oral hygiene care pamphlets, the score still improved significantly. According to the study of Paulsson *et al.* [30], the evaluated the educational level of nursing personnel affected the oral health education programs design. Low educational level group preferred practical procedures, while in the high educational level group preferred theoretical considerations. High educational level group had ability to perform oral hygiene for older persons better than low educational level group both baseline and after intervention. Furthermore, functional level of participants affected the result, in this study the interviewer had to read the questionnaire for all participants because they had poor eyesight.

Other limitations of this study were the method. At baseline, the researcher suggested and gave the appropriate oral hygiene aids for each participant. Consequently, the suggestion for pamphlet improvement about “Unable to find all recommended devices” cannot be evaluated. Moreover, the limitation of duration for participants to read and practice follow the oral hygiene care pamphlets was quite short resulting in the participants still remembered the question in the

questionnaire that researcher asked at baseline and focused on the knowledge that had been asked during read the pamphlet. The educational level more than half of participants also had a bachelor's degree and postgraduate, thus the score of knowledge and oral health skill was high at baseline. The educational level may had influenced participants. Therefore, when using this oral hygiene care pamphlet in a group with a lower education level, the results could not be as high as this study. However, the results from participants in this study could not be representative of the population due to low diversity of educational level of participants. In addition, these results could not apply to participants in rural area due to educational level of urban participants in this study.

From the previous studies the participants were caregivers and nursing staffs [35, 36]. Putten *et al.* compared nurses and nurse aides with a supervised versus a non-supervised implementation of the guideline by evaluation oral health knowledge and plaque control (natural teeth, denture) in older persons. The results showed that supervised group significantly improved the oral health knowledge, oral health care attitude and skills [35]. Le *et al.* carried out a study on residents in nursing homes. The caregivers were educated about oral care by using a video [36]. The results showed that PI and the knowledge of the caregivers improved from the beginning after received the oral health education program for 6 months. Then the improvement of oral care in older persons in those studies were done by the caregivers not by the older persons. The result of decreasing PI from those studies reflected the improvement of oral health care of older persons by caregiver. But this study the significantly reduced of PI was done by the functionally independent older persons, which can read oral hygiene care pamphlets and practice by themselves, then the result reflected the real ability of the older persons. Therefore, this protocol should be available for anyone who can read and understand.

The participants with high educational level in urban area may have different opinions from participants in the rural area such as participants in this study favored formats in pamphlet as well as clip video since they prefer watching animation than reading book. Sometimes participants in the rural may prefer reading than watching video clip and the suggestion for pamphlet improvement about “Pamphlet is not interesting” may not be highest value in rural participants. These suggestions depend on behavior of individual and community in each region.

This study collected data about suggestion for pamphlets improvement and additional suggestion about pamphlets in order to be developed oral hygiene care pamphlets to be most responsive to older persons. The results showed that the majority of participants understood almost all contents. However, the majority thought that pamphlets were not interesting followed by no illustration make it difficult to understand. The results of this study suggested that should adjust the format by design to be more interesting such as using clearly cartoon drawings, add real illustration, reduce duplicated contents, larger font size and clearly vocabulary that can be easily to understand and follow by older persons. Many participants preferred teaching by demonstration would lead to understand the contents correctly than only giving the pamphlets then develop the oral hygiene care protocols in the form of video clips would easy to access from the older persons.

Conclusion

Currently entering the aging society, the member of older persons is steadily increasing compared to the entire population. Older persons are difficult to access treatment and insufficient medical staffs. From this study, the medical staffs have attempted to develop oral hygiene care pamphlets and to evaluate it in various aspects for the older person to receive the most benefit and satisfaction. This study found that the oral hygiene care pamphlet had significantly improved oral health knowledge, oral health skill and oral hygiene of functionally independent older persons.

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