

Oral Health of Older Adults in Long-Term Care Facilities: Effects of an Oral Care Program

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Abstract

Aims and Objectives: Examine the effects of an oral care program among older adults in long-term care facilities.

Background: The inability to use oral care instruments and incorporate oral care in nursing care routines makes oral care easy to neglect. Poor oral care increases food residue in oral cavities, dental plaque, and oral mucosa problems.

Design: The design of this study was a quasi-experimental study. Fifty-four participants were recruited by convenience sampling from two long-term care facilities in northern Taiwan, and they were randomly assigned to either an experimental group ($n = 24$) or a control group ($n = 30$).

Methods: Participants within the experimental group received four-week of an oral care program, while participants in the control group received routine oral care. Participants were interviewed before and after the program regarding demographic information, subjective oral health status, and objective oral health status. The subjective oral health status was measured by the Oral Health Impact Scale-14 (OHIP-14), and the objective oral health status was measured by the plaque status as well as the Oral Health Assessment Tool (OHAT).

Results: The study results showed that the OHAT results ($F=21.094$, $p<0.01$) and plaque status ($F=4.438$, $p<0.05$) of the experimental group improved significantly.

Conclusions: Older adults living in long-term care facilities have a high frequency of oral problems and a comprehensive oral care program may improve their oral health.

Relevance to Clinical Practice: It is imperative to educate caregivers in long-term care facilities on the importance of oral care, especially regular oral care is needed for older adults as it is part of their quality of life.

Keywords: Elders; Long-term care facility; Oral care

Introduction

The growing population of older adults highlights the imminent problem of gerontological care. While promoting longevity, disease prevention as well as oral care should be emphasized to improve quality of life (QOL) of older adults [1]. Especially, poor oral health affects the independence, disability rate, and mortality rate of older adults [2]. Physical frailty, chronic diseases, polypharmacy, and reduced

cognitive functions result in reduced activities of daily living (ADLs) and instrumental ADLs (IADLs) which in turn reduce oral self-care and later exhibit poor oral health among older adults in long-term care facilities. Consequently, older adults develop dependency on caregivers for oral care, and thus become susceptible to oral diseases, and are prone to developing systemic diseases, such as diabetes, cardiovascular diseases, stroke, and pneumonia [3-5].

The poor provision of oral care to older adults in long-term care facilities is possibly attributable to high staff workloads, increasing numbers of highly dependent residents, and insufficient time and funding [6-9]. The inability to use oral care instruments and incorporate oral care in nursing care routines makes oral care easy to neglect. Poor oral care increases food residue in oral cavities, dental plaque, oral mucosa problems, and halitosis. Then older adults with poor oral health will avoid eating certain cuisines, exhibit speech difficulties, and avoid chewing food and smiling. Moreover, oral pain, damage to the oral health, and oral diseases can in turn worsen functional limitations, physical pain, and physiological, psychological, as well as social discomfort [10]. However, relatively few studies have examined the effects of oral care programs on the oral health of older adults in long-term care facilities. Therefore, the purpose of this study was to develop a comprehensive oral care program and further examine its effects on improving the oral health conditions among older adults.

Background

Common oral health problems among older adults include missing teeth, periodontitis, dental caries, and xerostomia [11,12]. Poor oral health is detrimental to social and interpersonal interactions of older adults [13] and increases the risk of developing infections. However, these risks are frequently underestimated, and thus oral care has not been prioritized [14].

Approximately 70% of older adults have missing teeth. Missing teeth and oral diseases have significant effects on the physiological, psychological, and social aspects of older adults' QOL [2]. Periodontitis is the primary cause of missing teeth among older adults, with approximately 25% of missing teeth caused by severe periodontitis. Periodontitis is a chronic inflammatory disease that is associated with systemic diseases such as diabetes, cardiovascular diseases, and respiratory diseases. Therefore, studies have stated that maintaining the number of natural teeth in older adults is vital [15]. Dentures frequently serve as replacements for missing teeth, and yet wearing dentures can reduce food intake, limit dietary selections, and increase the selection of cuisines with minimal nutritional value. Also, extended denture wearing is unsuitable for older adults who exhibit unintentional weight loss, and denture replacements are perceived as difficult and costly [15]. Effective oral hygiene can prevent dependent and disabled older adults from developing dental caries and missing teeth as well as improve their oral health [16]. Another common oral health problem is xerostomia. The prevalence of xerostomia increases with age and may be associated with drug or multiple drug consumption. Geriatric xerostomia is defined as the subjective perception of having a dry mouth. This condition influences people's socialization and mood, and may decrease their QOL [17].

Factors affecting the oral health of older adults in long-term care facilities include the following: a reduced capability of maintaining oral hygiene, chronic diseases, drug-related xerostomia, a history of gingivitis or exposed tooth roots, poor nutrition, consumption of sugar-containing foods, smoking, and an inability to undergo routine dental examinations [18]. As a result of limited communication capabilities or dysfunction, elderly residents in long-term care facilities cannot express

their oral health-related concerns or care for their dental hygiene. In addition, the absence of routine dental evaluations in institutions leads to deteriorating oral health among residents. Consequently, gingivitis or candida infections occur, thereby affecting the QOL and lifestyles of residents [19]. Management of dental plaque and gingivitis effectively reduces the incidence of pneumonia, and thus, developing and sustaining an oral care program should be an initial and crucial step in pneumonia prevention. Studies indicated that dental plaque management reduces periodontitis-related problems, and that effective dental plaque management involves brushing the teeth, cleaning the spaces between the teeth, and chemical oral cleansing [20]. Tooth loss, educational levels, smoking behavior, and the cognitive status of elderly people are significantly associated with their body-mass index (BMI) [21]. Most oral disease risk factors are preventable; improving the lifestyle (such as eating habits, and reducing excessive tobacco and alcohol use) and oral care standards can reduce the occurrence of oral diseases [22]. Although long-term care facilities possess limited resources, integrating oral care aids can reduce the incidence of systemic diseases and improve the general QOL of residents in long-term care facilities [23]. Professional oral care has shown to effectively reduce oral cavity infections and improve the oral health of older adults in long-term care facilities [24].

Methods

Research design

This was a quasi-experimental pre- and post-intervention study design. Eligible participants were recruited by a convenience sampling and were randomly assigned to either an experimental or a control group by flipping a coin. Participants in the experimental group received an oral care program, while those in the control group received routine care.

Setting and participants

After the institutional review board approval of human subject by Taipei Medical University, participants were recruited from two long-term care facilities in northern Taiwan. The inclusion criteria were 1) being aged ≥ 65 years, 2) having clear consciousness and being able to understand instructions, 3) being able to communicate in Taiwanese or Mandarin, 4) being able to walk without assistance, 5) consuming food orally, and 6) agreeing to participate in the study. Older adults who had been diagnosed with dementia or head-neck cancers were excluded. Besides, older adults who used a nasogastric tube or trachea tube, were unable to use the upper extremities, or had trismus were also excluded. To calculate the sample size for this study, an effect size of 0.5 was used [25]. G-power analysis software established that a sample size of 114 participants required a power of 0.75 and a type I error of 0.05. In this study, 54 participants were recruited in the current study, and the effect size was estimated to be 0.74 based on the results, which would contribute a power of 0.76.

Measurements

Demographic data: Age, gender, marital status, education, and religion were collected for demographic data by face-to-face interview and Medical records.

General health status: The general health status was assessed by the Mini-Mental Status Examination (MMSE) for cognitive status, number of diseases, number of medications, dry mouth or not, pain in the teeth and dominant hand, pain in dominant hand, number of teeth, and ADLs as measured by the ten-item Chinese version of the Barthel index.

General oral care: General oral care was assessed by the frequency of changing toothbrushes, the frequency of brushing the teeth, the timing of brushing, tools used to clean the mouth, and tools used to clean the dentures.

Nutritional status: The nutritional status was assessed by the BMI, eating time (minutes), and food intake (gram). Eating time and food intake were measured both lunch and dinner, got the average value of this two times result.

Subjective oral health status: The subjective oral health status was measured by the Oral Health Impact Scale (OHIP)-14. The 14 items are divided into seven domains (functional limitation, pain, psychological discomfort, physical disability, psychological disability, social disability and handicap). Respondents were asked to provide answers on a five-point Likert scale (5, very often; 4, quite often; 3, sometimes; 2, once a while; and 1, never) for each question. A higher score indicates a poorer quality of oral health, and the total possible score ranges from 14 to 70. The Chinese version of the OHIP-14 was used in the current study. The internal consistency of Cronbach's α was 0.862 to 0.882, and the intra-class correlation coefficient (ICC) was 0.86 to 0.835 [26].

Objective oral health status: The objective oral health status was measured by the Oral Health Assessment Tool (OHAT). There are eight items on the scale. A dentist assessed the oral health and recorded the frequency of each item as either 0 "healthy", 1 "changed", or 2 "unhealthy". A higher score indicates a poorer quality of oral health, and the total possible score ranges from 0 to 16. It is widely used by nurses to assess the oral health status among residents in long-term care facilities [27]. The ICCs for intra-carer and inter-carer reliabilities were 0.78 and 0.74, respectively [28].

Dental plaque: Dental plaque was assessed by a dentist with a dental disclosing solution. The dentist rated the severity of coloring on the teeth from 0 "non-colored" to 3 "severely colored"). A higher score indicates more dental plaque and a poorer quality of oral care.

Intervention

The intervention was defined as an oral care program. The duration of the oral care program was four-week, and participants received oral care twice immediately after breakfast and dinner every day. Every participant was taught individually according to his/her own oral hygiene and physical and cognitive abilities, for a minimum of 30 minutes by a research assistant. In this context, feasible brushing techniques and handling of tooth/interdental space brushes were taught, and advice about toothpastes and mouth rinses was given (Table 1). In addition, handling of the prosthesis was explained to prosthesis wearers. Participants received a toothbrush, a denture brush, toothpaste, mouth rinse, and an information brochure on the oral care program. In the control group, participants received the usual care with no intervention. For ethical reasons, at the end of the study, participants in the control group also received the same oral care program.

Table 1: Oral care program.

Phase	Contents
Preparation	a. environment
	b. appropriate equipment including a basin and mirror
	c. oral cleaning tools
Implementation	a. identifying and placing tools
	b. maintaining a comfort and safe position
	c. using napkin and/or bib clothing
	d. taking in water with tooth mug
	e. brushing techniques including bass methods and denture cleaning
Finish	a. replacing oral cleaning tools at a ventilated place
	b. after oral cleaning tools are dry, put them back at a reachable place

Procedure

For ethic consideration, this study was approved by the TMU-JIRB (Taipei Medical University Joint Institutional Review Board, Approval number: 201208008). After informed consent was received from each resident in the two long-term care facilities, research assistants used instruments to collect data before and after the oral healthcare program were instituted. Dental plaque was assessed by a dentist before and after the oral healthcare program was carried out. Residents in the experimental group received four-week of the oral healthcare program, while the control group received their usual care.

Statistical Analysis

We used IBM SPSS statistics 19.0 to conduct the data analysis. The distribution and comparison of basic attributes of the research participants and categorical variables are presented using frequency distributions and percentages. Frequencies and percentages were performed for categorical variables. Interval variables were described using mean values, standard deviations (SDs), and maximum and minimum values. A Chi-squared test, Fisher's exact, and Mann-Whitney *U*-test were used to compare differences in demographics between the two groups. An analysis of covariance (ANCOVA) was used to compare the effects of the oral care program between the two groups. A multiple regression analysis was used to predict the variances of the independent variables on the dependent variable.

Results

Demographics and baseline data

Sixty-eight residents were recruited; only 54 residents completed the post-test, 30 in the experimental group and 24 in the control group. The attrition rate was around 16.7% to 25%. No statistically significant differences in demographic data were identified between the remaining participants and participants who withdrew according to a Mann-Whitney *U*-test. The overall mean age was 83.7 (SD=7.20) years. The majority of participants were female (61.11%), had less than an elementary school education (55.56%), and were widowed (64.81%). Overall means of the BMI, food intake, and eating time were 24.26 kg/m² (SD=3.43), 404.6 g (SD=69.6), and 20.7 minutes (SD=5.2), respectively.

The overall means of the MMSE, ADL, ADL-5 subscales, and number of diseases were 24.59 (SD=4.91), 81.76 (SD=17.30), 36.37 (SD=5.56), and 2.37 (SD=1.02), respectively. Among all participants, 79.62% still had their real teeth, and 46.3% had dentures. Most participants (86.05%) used a regular toothbrush for their oral hygiene, and most of them (76.22%) also used a regular toothbrush to clean their dentures. Over half of them (51.16%) cleaned their teeth twice a day, and 22.22% had experienced tooth pain. The overall mean scores of the OHIP-14, OHAT, and dental plaque were 19.59 (SD=5.47), 4.49 (SD=1.22), and 7.05 (SD=4.54). Table 2 shows the details and significant differences in demographics and baseline data between the experimental and control groups. The age and educational level significantly differed between the two groups; these factors were used as a covariance for the statistical analysis. ADL scores also differed between the two groups, but the ADL 5-subcales which are most relevant to the oral care ability did not show a significant difference between the two groups. Therefore, ADL scored were not included in the covariance analysis.

Effects of the oral healthcare program on oral health and nutrition

Residents in the experimental group had significantly lower scores on the OHAT ($F=21.094$, $p<0.001$) and detail plaque ($F=4.438$, $p=0.044$), and had shorter eating times ($F=5.372$, $p=0.025$) than residents in the control group. Residents in the experimental group had

lower scores on the OHIP-14 and greater BMI values and food intake after receiving the intervention, but a statistically significant difference was not reached between the two groups (Table 3).

Using a multiple regression analysis to examine predictors of OHIP-14 scores, 15.8% of the variance in the subjective oral health was explained by tooth pain and the number of real teeth over 20 ($R^2=0.158$, $F=11.56$, $p=0.001$). Predictors of the OHAT were the group (control or experimental group) and change of toothbrush, with these two factors explaining 37.2% of the variances in the objective oral health ($R^2=0.372$, $F=11.560$, $p=0.0001$) (Table 4).

Discussion

The effect of the oral care program

The purpose of this study was to examine the effects of an oral care program among older adults in long-term care facilities. Results of this study showed an improvement on objective oral health status

Table 2: Differences in demographics and baseline data between the two groups.

Variables	Experimental (n=30) n (%) / mean ± SD	Control (n=24) n (%) / mean ± SD	Statistics χ^2/Z
Age (years)	82.14 ± 7.39	86.34 ± 4.99	-2.210 [†] *
Gender			2.667 [§]
Male	13 (43.3)	8 (33.3)	
Female	17 (56.6)	16 (66.7)	
Educational level			13.000 [‡] *
Elementary	21 (70)	9 (37.5)	
Junior or senior high school	5 (16.67)	8 (33.33)	
College and above	4 (13.33)	7 (29.17)	
ADLs	78.50 ± 17.87	86.88 ± 15.73	-2.590*
ADL-5 subscales [†]	36.33 ± 3.70	37.08 ± 5.50	-1.503
No. of diseases	2.50 ± 1.17	1.92 ± 0.88	-1.652
Body-mass index (kg/m ²)	24.26 ± 3.89	24.14 ± 2.81	-0.122
Food intake	389.95 ± 71.8	422.99 ± 63.52	-1.863
Eating time	20.47 ± 4.86	21.06 ± 5.56	-0.479
Real teeth			1.650 [§]
Yes	22 (73.33)	21 (87.5)	
No	8 (26.67)	3 (12.5)	
Dentures			
Yes	13 (43.33)	11 (45.83)	
No	17 (56.67)	13 (54.17)	
OHIP-14	20.93 ± 6.05	19.21 ± 6.41	19.21 ± 6.41
OHAT	4.43 ± 1.41	3.54 ± 1.10	-0.783
Dental plaque	8.14 ± 5.08	7.05 ± 3.97	-0.891

OHIP, Oral Health Impact Scale; OHAT, Oral Health Assessment Tool, ADLs, Activities of daily living.

Significance levels * $p<0.05$.

[†]ADL-5 subscales: feeding, grooming, toilet use, bathing, and dressing.

[‡]Chi-squared test

[§]Fisher's exact test

[†]Mann-Whitney *U*-test

Table 3: Effects of the oral care program on oral health and nutrition.

Variable	Experimental group (n=30)	Control group (n=24)	Statistics
	mean ± SD	mean ± SD	χ^2/F
Subjective oral health status			
OHIP-14			
Pre-test	20.93 ± 6.05	19.21 ± 6.41	-1.276
Post-test†	18.16	21.06	3.01
Objective oral health status			
OHAT			
Pre-test	4.43 ± 1.41	3.54 ± 1.10	-0.783
Post-test†	2.89	4.11	21.094**
Plaque status			
Pre-test	n=22	n=21	
Pre-test	8.14 ± 5.08	7.05 ± 3.97	-0.891
Post-test†	6.19	8.02	4.438*
Nutritional status			
Body-mass index (kg/m ²)			
Pre-test	24.26 ± 3.89	24.14 ± 2.81	-0.122
Post-test†	24.81	24.22	1.143
Food intake (g)			
Pre-test	403.95 ± 66.66	422.99 ± 63.52	-0.504
Post-test†	435.21	425.14	0.498
Eating time (min)			
Pre-test	20.47 ± 4.86	21.06 ± 5.65	-0.479
Post-test†	19.07	22.39	5.372*

OHIP, Oral Health Impact Scale; OHAT, Oral Health Assessment Tool.

Significance levels * $p < 0.05$, ** $p < 0.001$.

†Covariance with age and education.

Table 4: Summary of the multiple regression analysis for predictors of the subjective and objective oral health ($n=54$).

Variable	Adjusted R ²	F
OHIP-14		
Tooth pain	0.115	12.89*
Tooth pain, no. of true tooth over 20	0.158	11.56**
OHAT		
Group	0.305	17.51**
Group, change of toothbrush	0.372	11.56**

with the experimental group scored significantly lower than did the control group. This study is consistent with the findings of Jablonski and colleagues [29], which consisted of a one-group experiment performing twice-daily oral hygiene care that found a significant improvement on objective oral health status by reduction in the OHAT mean scores.

Performing ANCOVA using adjusted OHIP-14 post-test means, the adjusted OHIP-14 post-test mean of the experimental group was significantly reduced compared to that of the pre-test; the effects of the oral program on subjective oral health status failed to reach statistical significance between the experimental and control group. This suggests that participants receiving care in addition with the oral care program showed an improvement on oral health-related QOL. The statistically insignificant results of subjective oral health status were possibly associated with the gradual improvement of the oral health-related QOL and limitations created by the small sample. This study was unique as few studies examined the effects of an oral care program on subjective oral health status using the OHIP-14; while previous studies primarily examined the relationships among dental treatments, dental care-seeking behaviors, and oral conditions (including periodontitis, dental caries, the masticatory capability, and occlusal function) with subjective oral health status based on the OHIP-14 [30,31].

Oral health status changes after the oral care program

Subjective oral health status was measured using the OHIP-14 and it comprises seven dimensions. Among these dimensions, pain is measured according to older adults' oral pain and discomfort when eating, while psychological discomfort is measured according to older adults' perceptions of stress when eating and oral discomfort, and physical disability is measured according to older adults' dissatisfaction with the diet and inability to eat continuously. Pain and stress perception is a general concept; hence, participants may have responded according to their general and subjective perceptions and not focusing on their oral issues. Consequently, the insignificant differences in the OHIP-14 scores were potentially caused by subjective descriptions of pain and stress. To understand research participants' diverse food types and meal selections in order to improve the oral health-related QOL of older adults, we suggest future studies not only extend the program duration but also provide nutrition counseling.

Findings that oral care effectively reduced dental plaque are consistent with those of previous studies [32,33]. Specifically, the experimental group exhibited significant improvement in dental plaque following enrollment in the oral care program. The literature indicates that brushing teeth is the primary method for controlling dental plaque, and the Bass technique [34] is a frequently recommended method. Hence, if the daily tooth brushing technique is incorrect dental plaque might not be completely removed [35]. Therefore, the 4-week oral care program in this study instructed participants to accurately performing the Bass technique, conducting regular oral hygiene care, and selecting appropriate oral hygiene instruments. These components were shown to effectively remove dental plaque, improve the condition of dental plaque in elderly residents, and enhance the oral hygiene [36] as well as health of elderly residents.

Predictors of the subjective and objective oral health

Results of the stepwise regression analysis indicated that toothaches and the presence of 20 or more natural teeth were significant predictors of the subjective oral health status. Specifically, possessing 20 or more natural teeth was indicative of the mastication capability. In this study, participant changes in toothaches and mastication after enrolling in the four-week oral hygiene program were not reflected on the subjective oral health status.

Among the study participants, 22.22% did not regularly replace their toothbrushes. This indicated that few older adults adhered to regular toothbrush replacements in long-term care facilities. We suggest long-term care facilities replace toothbrushes proactively and regularly in order to improve knowledge and behaviors of resident regarding routine toothbrush replacement. Regarding oral hygiene devices, two residents used powered toothbrushes, and powered toothbrushes provided superior plaque removal effects compared to manual toothbrushes [36]. Therefore, we recommend that long-term care facilities provide elderly residents with training in using powered toothbrushes to facilitate easy dental plaque removal. As for the cleaning agents used to clean removable dentures, 62.5% of the participants used toothpaste, which is a practice that has been shown to shorten the lifespan of dentures and increase the risk of infection [37]. We suggest that long-term care facilities organize workshops or events to increase residents' knowledge of daily denture care to increase the lifespan of removable dentures and reduce the risks of infection.

Limitation

The study was conducted within a certain region in the country. Moreover, the results of this study need to be interpreted with caution as quasi-experimental design and the small sample size may limit the generalizability of these findings. Future studies may use enlarged sample size to analyze and estimate the target population by parametric statistical methods.

Conclusion

Overall, this study showed that the experimental group exhibited superior oral health than did the control group after the intervention. The four-week oral care program implemented in this study involved using correct oral hygiene methods, regular oral hygiene care, and appropriate dental cleaning instruments. The program effectively improved the overall oral health of the elderly residents.

Relevance to Clinical Practice

Poor oral health is detrimental to physical, psychosocial and interpersonal interactions of older adults and it increases the risk of developing inflammatory disease then leads to systemic diseases. The importance of oral care is frequently underestimated and it is very preventable. Professional oral care has shown to effectively reduce oral cavity infections and improve the oral health of older adults in long-term care facilities. Consequently, it is imperative to educate caregivers in long-term care facilities on the importance of oral care, especially oral care is needed for older adults and it is part of their quality of life.

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