Original article

Oral health status and physical, mental and cognitive disabilities among nursing home residents in Jordan

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Objective: The purpose of this study is to describe physical, mental and cognitive disabilities and periodontal status as indicated by periodontal health, edentulism and use of dentures among nursing home residents in Jordan.
Methods: A sample of 221 subjects with a mean age of 62.4 years (121 males and 100 females) from nursing home residents in Jordan were recruited to participate in this study. Oral health status, mini mental state examination (MMSE), Geriatric Depression Scale (GDS), Tinetti Assessment Battery for gait and balance (TAB) and disability of arm, shoulder and hand test (DASH) were assessed for all subjects.
Results: The response rate was about 88%. The multivariate analysis showed that the degree of upper limb disabilities, as measured by DASH, and reporting not brushing of teeth were the main risk indicators for severity of periodontal disease. Residents with dentures were found to have significantly higher cognitive abilities scores (MMSE), better upper arm abilities (DASH) and gait and balance score (TAB) in comparison with edentulous adults without dentures. Edentulous residents were found to suffer more from cognitive impairment (MMSE) than dentate residents. There was no predilection of upper limb (DASH) and lower limb (TAB) disabilities or depressive symptoms (GDS) for edentulous over dentate subjects.
Conclusions: Results suggest that nursing home residents with a variety of physical, cognitive and psychological disabilities are at increased risk of deterioration of their oral health. All those associated with the health of residents need to be aware of this issue and take preventive and therapeutic measures as needed.

Keywords: oral health, nursing homes, physical, mental, cognitive, disability.

Introduction

Globally, nursing home residents suffer from numerous problems including physical disabilities, mental disabilities, cognitive disabilities, self-neglect and lack of social and financial support and resources. These problems may increase the risk for oral diseases compared to healthy and independent-living individuals[1–7].

Previous research showed that oral health is poor in institutionalised individuals, especially in those with cognitive impairments[8–10]. Older adults with special needs have an increased risk of dental plaque accumulation, dental caries, gingivitis, periodontal diseases and becoming edentulous[10,11]. The prevalence of coronal and root caries among nursing home residents has also been shown to be many times greater than that of community-dwelling older adults[12]. In addition, studies have shown that nearly 50% of nursing home residents were completely edentulous[13,14] and more than 40% of the residents reported difficulty biting or chewing[14], a remarkably high percentage of the average edentulous population

aged 65 and above[15]. This suggests that periodontal disease and tooth loss are serious health issues in nursing home residents.

Multiple factors, such as old age, socio-demographic characteristics, poor oral health status, cognitive impairment, physical disability (i.e. gross and fine motor problems), systemic health and others are considered to be associated with oral and periodontal diseases in institutionalised individuals[1,2,7,13,16–21]. However, how these risk factors interactively affect oral diseases in this population remains unknown. One older study on a small sample found, through bivariate analyses, that individuals with a greater deficit in cognitive function were less likely to have reported getting dental care[22]. A second study, found that individuals with relatively low or moderate cognitive function were significantly less likely to have dentist visits compared with those with high cognitive function[23]. However, because of the limitations of the data, Walsh *et al.* were not able to include some important variables, such as clinical examinations of oral health status and self-rated quality-of-life measures and associated medical conditions in the analysis. Without these measures, the effect of cognitive function on dental care might be confounded because of the collinearity among cognitive function, oral health and specific medical conditions.

In addition, previous studies have found that physical disability was associated with tooth loss among institutionalised individuals[14,24,25]. However, assessments of physical disabilities of upper and lower limbs were based on standard instruments, such as Tinetti Assessment Battery for gait and balance (TAB) and disability of arm, shoulder and hand test (DASH), which were not available in the dental settings/clinics. Therefore, previous studies could not be able to assess the impact of physical function impairment on oral health and periodontal status of institutionalised individuals using the standard functional assessment. To address this issue, we conducted this first national study of the institutionalised Jordanians to investigate the factors that are affecting oral health status in nursing home residents. The lack of understanding on these issues not only increases difficulty for dental professionals in managing oral diseases in adults with special needs, but also affects quality of care for these vulnerable individuals[8,9,19,26,27]. In this study, we aimed to describe physical, mental and cognitive disabilities and some oral problems as indicated by periodontal health, edentulism and use of dentures among nursing home residents in Jordan.

Materials and Methods

Study sample

All nursing home residents in Jordan were invited to participate in this study. Jordan has 11 nursing homes, of which eight homes are located in the capital city (Amman), one each is located in the city of Zarqa and city of Alfehays and the last one is located in the city of Irbid. These nursing homes have in total around 300 male and female residents. Participants signed the consent form before data collection which was approved by the Institutional Review Board of Jordan University of Science and Technology (JUST). After research assistants took permissions from nursing homes, they personally invited subjects to participate in this study. Consent forms were read and explained by the research assistants for all participants. The consent forms were signed on behalf of illiterate subjects, who accepted to participate (i.e. gave verbal acceptance), by their care givers (e.g. nurses, social workers, nurse assistants, etc.) present on in the day of data collection. Subjects who were not able to sign the consent form because of severe psychological disabilities or subjects with severe cognitive impairments, as reported in their medical files, and subjects who refused to participate were excluded from the study.

Soft tissues examination

The clinical dental examination was conducted using individually wrapped and sterilised examination kits including dental mirrors, cow horn explorer, dental tweezers and periodontal probe. Dental examinations were conducted by a single examiner. Dental examinations included measurements of Clinical Attachment Loss (CAL) and presence or absence of teeth. CAL refers to the estimated position of the structures and supports the tooth as measured by periodontal probing. It provides a reliable indication of an estimate of a tooth's stability and loss of bone support. It is one of the best indicators to assess periodontal diseases. It gives an indication of past periodontal disease and may give better indication of current[28]. Also, subjects were asked whether they have and use dentures. Residents were examined while sitting in a semi-supine position in an ordinary chair in their rooms using daylight supplemented with a head light. Teeth were dried with gauze and when necessary, cotton rolls were used to remove any residual debris. Full-mouth periodontal examinations were performed, and information was recorded on

a prepared examination form by a research assistant. The examiner was trained and calibrated to perform precise diagnosis of dental examination. The examiner was calibrated by a university faculty member by co-examining 20 dental patients of Jordan University of Science and Technology's dental clinics prior to study commencement until calibration was confirmed. There was a 98.4% percentage of agreement between the examiner and trainer. To assess intraexaminer reliability during the study period, approximately 10 participants of the total sample were examined twice using the CAL index. The kappa value of intraexaminer reliability was 0.98.

The periodontal status of all teeth was assessed using the CAL. Periodontal probes were used to measure CAL and were measured at six sites (mesio-facial, mid-facial, disto-facial, mesio-lingual, mid-lingual and disto-lingual) per tooth for all teeth. The severity of periodontal disease was determined depending on the mean of the total amount of CAL for all remaining teeth. A clinical oral examination for soft tissues was done for all edentulous subjects with and without dentures.

Instruments and scales

A trained and calibrated occupational therapist collected demographics and medical history for subjects. Subjects were asked about their smoking habits and how many times per week do they brush their teeth and whether they suffer from any oral discomfort. Subjects' age and medical conditions were obtained from their medical files at the nursing homes.

In addition, the occupational therapist performed the following evaluations:

Mini Mental State Examination (MMSE)[29], DASH[30], TAB[29] and Geriatric Depression Scale (GDS)[31].

The MMSE is a short (10 min) 30-point test that is used to screen and estimate the severity of cognitive impairment. The test includes simple questions and problems in a number of areas: the time and place of the test, repeating lists of words, arithmetic problems such as the serial sevens, language use and comprehension and basic motor skills. For example, one question asks to copy a drawing of two pentagons. A higher score means a better cognitive function and a lower score (<25 of 30) indicates cognitive impairments. This instrument was adapted culturally to be used for the Arabic speaking population[32].

The DASH questionnaire is a self-administered instrument developed as a measure of self-rated upper-extremity disability and symptoms. The DASH consists mainly of a 30-item disability/ symptom scale, scored 0 (no disability) to 100 (maximum disability). The tool gives clinicians and researchers the advantage of having a single, reliable instrument that can be used to assess any or all joints in the upper extremity. This instrument was adapted culturally to be used for the Arabic speaking population[30].

The TAB is a simple, easily administered test (10–15 min) that measures an individual's gait and balance. The test is scored on the individual's ability to perform specific tasks. Scoring of the TAB is done on a three-point ordinal scale with a range of 0–2. A score of 0 represents the most impairment; while a score 2 represent independence of the individual. The individual scores are then combined to form three categories of measures; an overall gait assessment score, an overall balance assessment score and a gait and balance score (i.e. TAB score). The maximum score for the gait component is 12 points. The maximum score for the balance component is 16 points. The maximum total TAB score is 28 points. A TAB score of 23 and below indicates subjects with gait and balance problems[29]. In this study, this instrument was adapted culturally to be used for the Arabic speaking population including the Jordanian population.

The GDS is a 30-item self-reported assessment, with well-established reliability and validity. It is originally found to identify depressive symptoms among the elderly. The GDS questions are answered as 'yes' or 'no' responses. The scale is used as a routine part of a comprehensive geriatric assessment. The GDS scale for the 30 questions considered normal if it ranged from 0 to 9. Scores from 10 to 30 indicate signs for depression[31]. In this study, this instrument was adapted culturally to be used for the Arabic speaking population including the Jordanian population.

Data processing and statistical analysis

Data were entered into a personal computer and analysed using the Statistical Package for Social Sciences (SPSS) software version 17.0 (SPSS®: Inc., Chicago, IL, USA). Frequency distributions, means and standard deviations were calculated. Chi-square test and Mann–Whitney U test were used for comparison between groups, dentate and edentulous. Furthermore, multivariate linear regression model analysis, analysing the association between explanatory (predictor) and outcome variables, was performed to test the association of the outcomes (severity of periodontal disease represented by CAL variable in mm), with independent

variables that were included in the model. Using the backward elimination method, all the possible variables were entered into the model. The independent variables specified in the variables list were then tested for possible removal from the model one by one at each step, based on the probability of F. The significance level for removal was 0.1. Regression coefficients (B) were generated and corresponding 95% confidence intervals (CI) for all significant variables. Moreover, multiple logistic regression model analysis was performed to predict the factors related to the using of denture among edentulous residents using backward Wald method, in such method, all the possible variables were entered into the model. The independent variables specified in the variables list were then tested for possible removal from the model one by one at each step, based on the probability of Wald statistic. The variable with the smallest significance composed to PIN (probability for entry; 0.05) was left in the model. If the significance level was greater than POUT (probability for removal; 0.1) the variable was removed. The stoppings happen when no more variables could be entered or removed. Odds ratios were generated and corresponding 95% confidence intervals (CI) for all significant variables. The level of significance was set at ($p \leq 0.05$).

Results

Response rate

Of eleven nursing homes in Jordan, three refused to conduct the screening for their residents citing privacy issues. This resulted in a final response rate of 72.7% of homes. The total number of residents in all eight nursing homes was 297 residents. Forty residents had severe dementia or mental retardation; therefore, they were excluded. Another 36 residents refused to participate in this study, resulting in a final sample of 221 subjects. Accordingly, the proportion of nursing home participants of the total number of residents in these eight homes is 74.4%.

Socio-demographic and personal characteristics

Of the 221 residents included in the current study, 149 subjects were dentate and 72 were edentulous. The residents aged between 28 and 100 years with a mean (SD) of 62.4 years (13.9). More than half of them (54.8%) were males. About 41% of subjects were illiterate, and less than 22% had high school education or more.

Table 1 Socio-demographic, personal characteristics and frequency distributions of medical conditions of study sample (*N* = 221).

Variable	N(%)
Age (Years)	
<55	69(31.2)
55–65	69(31.2)
>65	83(37.6)
Gender	
Male	121(54.8)
Female	100(45.2)
Educational level	
Illiterate	90(40.7)
Primary education	46(20.8)
Secondary education	37(16.7)
High school and above	48(21.7)
Smoking habit	
No	143(64.7)
Yes	78(35.3)
Residents' dentition status	
Edentulous	72(32.6)
Dentate	149(67.4)
Number of medical conditions and diseases	
0–1	87(39.4)
2	64(29.0)
≥3	70(31.7)
Diabetes mellitus (Yes)	52(23.5)
Hypertension (Yes)	74(33.5)
Stroke (Yes)	38(17.2)
Arthritis (Yes)	20(9.0)
Joint disease (Yes)	38(17.2)
Psychiatric disorders (Yes)	101(45.7)

Thirty-five per cent (35%) of participants were smokers. About 61% of the sample suffered at least two chronic diseases. The most common diseases reported among residents were psychiatric disorders, hypertension and diabetes mellitus, at 45.7, 33.5 and 23.5%, respectively (Table 1).

Physical, mental, cognitive disability and oral health scores among study sample

The frequency distributions for physical, mental and cognitive conditions among dentate and edentulous subjects are presented in Table 2. About 47% of nursing home residents' MMSE scores were less than 25 of 30, indicating cognitive impairments. Edentulous residents were found to suffer more from cognitive impairment than dentate residents. The mean MMSE scores among the two groups were significantly different ($p = 0.046$). The mean DASH score for all residents was 32.9%; however, as a DASH scores ≥50% as an indication of upper limb disability,

Table 2 Frequency (%) and Means (SD) of physical, mental and cognitive disability outcomes of the study sample (*N* = 220).

Variable	Edentulous N(%)	Dentate N (%)	p-value	Total N(%)
MMSE score			0.056*	
Impaired (<25)	41(56.9)	64(43.2)		105(47.7)
Not impaired (≥ 25)	31(43.1)	84(56.8)		115(52.3)
Mean (SD)	20.2(9.9)	22.5(9.29)	0.046**	21.76(9.5)
DASH score			0.864*	
<50%	48(67.6)	99(66.4)		147(66.8)
≥ 50%	23(32.4)	50(33.6)		73(33.2)
Mean (SD)	33.55(28.3)	32.6(31.7)	0.618**	32.89(30.6)
TAB score			0.522*	
<23	47(66.2)	92(61.7)		139(63.2)
≥ 23	24(33.8)	57(38.3)		81(36.8)
Mean (SD)	15.97(10.45)	15.46(11.16)	0.631**	15.6(10.9)
GDS score			0.533*	
Normal	27(37.5)	62(41.9)		89(40.5)
Depression	45(62.5)	86(58.1)		131(59.5)
Mean (SD)	13.4(8.88)	14.1(9.8)	0.668**	13.89(9.5)

MMSE, mini mental state examination; DASH, disability of arm, shoulder and hand test; TAB, tinetti assessment battery; GDS, geriatric depression scale; SD, standard deviation.
*(*p*-value >0.05, χ2-test), **(*p*-value >0.05, Mann–Whitney *U* test).

Table 3 Multiple logistic regression model for difference between dentate and edentulous residents (*N* = 217).

Dependent variable	Explanatory variables	Odds ratio	Significance	95% CI for B
Edentulous (1) vs. Dentate(0)	Constant	0.498	0.01	
	MMSE score			
	Impaired (<25)	1.83	0.047	1.01–3.3
	Not impaired (≥ 25)	1.0		

MMSE, mini mental state examination.

approximately one-third of participants (33.2%) exhibited these criteria. There was no predilection of DASH scores for edentulous over dentate subjects. Approximately 63% of residents had total gait and balance problems, as measured by TAB with TAB scores almost equal between the dentate and edentulous groups. Approximately 60% of the study sample suffered from depressive symptoms, as measured by the GDS. The GDS mean scores for the total sample were 13.9 with no statistical significant differences between edentulous and dentate residents. After performing the multiple logistic regression models, we found that edentulous residents were more likely to be with impaired cognitive abilities by 83% compared with dentate residents. (Table 3).

Multivariate analysis for severity of periodontal disease among dentate residents

Table 4 shows the risk indicators contributing to severity of periodontal disease (represented by

CAL) for the dentate subjects. A multivariate linear regression model was fit with the following predictive factors: age; gender; smoking; toothbrushing frequency; presence or absence of diabetes mellitus, hypertension, stroke, arthritis, joint diseases and psychiatric disorders; MMSE scores; DASH scores; TAB scores; and GDS scores.

The final model for risk of periodontal disease severity (CAL) included two predictors: disability of upper limb (DASH) and reporting not brushing of teeth. The CAL is increased by 0.16 mm for an increase of 10 units on the DASH (i.e. increase in upper limb disabilities). Furthermore, of the total nursing home residents (221 participants) 149 residents (67.4) were dentate. The CAL is increased by 1.58 mm among residents reported that they don't brush their teeth at all.

Dentures among edentulous residents

Only 22 subjects of the edentulous residents (30.6%) reported wearing dentures with about

Table 4 Multivariate linear regression model for CAL in mm (severity of periodontal disease) among dentate residents ($N = 149$).

Dependent variable	Explanatory variables	B	t-value	Significance	95% CI for B
CAL	Constant	1.61	2.03	0.044	0.042–3.17
	DASH score	0.016	2.61	0.010	0.004–0.028
	Brushing teeth/week (Yes/No)	1.58	3.62	0.0001	0.2–2.45

CAL, clinical attachment loss; DASH, disability of arm, shoulder and hand test.

Table 5 Dentures' variables among edentulous residents and their association with of physical, mental and cognitive disability ($N = 72$).

Variables	N(%)	MMSE mean (SD)	DASH mean (SD)	TAB mean (SD)	GDS mean (SD)
Having dentures					
No	50(69.4)	17.7(10.4)*	38.6(27.8)**	14.3(10.2)	14.2(8.8)
Yes	22(30.6)	26.1(5.4)	22.4(26.7)	19.6(10.4)***	11.7(8.9)
p-value	>0.05	0.000	0.009	0.036	>0.05
Soreness					
No	13(59.1)	27.6(3.1)	16.3(25.4)	22.3(9.9)	9.7(9.6)
Yes	9(40.9)	23.8(7.3)	31.1(27.4)	15.7(10.2)	14.6(7.5)
p-value	>0.05	>0.05	>0.05	>0.05	>0.05

MMSE, mini mental state examination; DASH, disability of arm, shoulder and hand test; TAB, tinetti assessment battery; GDS, geriatric depression scale; SD, standard deviation.
*Mann–Whitney U test, significant at (*p*-value 0.000), **(*p*-value 0.009), ***(*p*-value 0.036).

Table 6 Multiple logistic regression model for using denture among edentulous residents ($N = 70$).

Dependent variable	Explanatory variables	Odds ratio	Significance	95% CI for B
Denture use (1) vs. non-use(0)	Constant	0.129	0.000	
	MMSE score			
	Impaired (<25)	1.0	0.008	1.5–14.5
	Not impaired ($\geq$ 25)	4.7		
	TAB score			
	<23	1.0	0.028	1.14–11.15
	$\geq$ 23	3.6		

MMSE, mini mental state examination; TAB, tinetti assessment battery.

41% of them reporting discomfort where the dentures contact with oral mucosa. Edentulous residents who wear dentures demonstrated significantly higher cognitive abilities (mean MMSE = 26.1) compared with those who don't wear dentures ($p = 0.0001$). Similarly, denture wearers revealed better upper limb abilities (mean DASH = 22.4%) in comparison with non-denture wearers ($p = 0.009$). The gait and balance score was found to be higher (i.e. better lower limb abilities) among denture wearers (mean TAB = 19.6) compared with the comparison group ($p = 0.036$). However, there was no significant difference between both groups regarding to geriatric depression scores (Table 5). Table 6 shows the factors related to using/wearing of denture among edentulous residents. To account for this outcome, multivariate logistic regression analysis models were performed after entering all factors we intended to study in the model (MMSE, DASH, TAB and GDS). The model identified both not impaired cognitive abilities (MMSE) and better lower limb abilities (TAB) as indicators for denture use. Edentulous residents with not impaired cognitive abilities (MMSE $\geq$ 26) were about five times more likely to use/wear denture compared with residents with impaired cognitive abilities (MMSE < 26). Similarly, edentulous persons with better lower limbs abilities (TAB $\geq$ 23) were about four times more likely to wear/use

denture compared with persons with worse lower limbs abilities (TAB < 23).

Discussion

The main purpose of this study was to describe physical, mental and cognitive disabilities and some oral problems as indicated by periodontal health, e-dentulism and use of dentures among nursing home residents in Jordan. Nursing homes in Jordan only provide general medical evaluation for their residents by general practitioners and do not offer dental services, mental health services, rehabilitation services or allied health services for their residents. If these services are needed, then residents could go to facilities outside these nursing homes, but would have to pay for them out of pocket. Although there is typically great need for these services, they are not currently part of the care provided in nursing homes in Jordan, and most older adults in nursing homes cannot afford to obtain them on their own.

This study, with 221 nursing home residents in Jordan, provides a representative sample of nursing home residents in the country. Thus, results of this study can be generalised to all institutionalised subjects. The majority of residents had compromised oral health. One-third of residents suffered from total edentulism, and most of the remaining dentate residents exhibited periodontal disease (90%). Of the edentulous group, only about 30% wore dentures. Of denture wearers, 41% reported having soreness with their dentures. These findings are consistent with previous studies that showed nursing home residents are at an increased risk for tooth loss and periodontal diseases[1–7,11,12]. Tramini *et al.*[13] found that among 321 long-term care residents, more than 50% had lost 21 or more teeth at the time of examination. Similarly, Peltola reported that among 260 nursing home residents, the mean number of functioning teeth was only 10.6, indicating remarkable loss of oral function in these individuals[11]. A slightly older study showed that nearly 50% of nursing home residents had lost their natural teeth completely, and more than 40% of the residents reported difficulty biting or chewing[14] which was higher than the average edentulous rate in people aged 65 and above[15]. Furthermore, because of the wide variation of age of residents, some residents may be watched by health system before residing at the nursing home. These indications may suggest that tooth loss and periodontal diseases could be a serious issue for nursing home residents. Extensive preventive and restorative dental measures are needed for this population.

The mean DASH score was significantly lower for subjects who wear dentures compared to subjects who do not wear dentures (22.4 vs. 38.6), and it was also lower for dentate subjects with sever periodontitis ($p = 0.01$). These results support the findings of previous studies indicating that physical disabilities negatively affect tooth loss, periodontal health and dental care utilisation[1,2,14,33,34]. In addition, a study assessed 205 nursing home residents in Tokyo found that there was significant and direct relationship between the amount of physical ability of upper limb (including ability to dress/undress, ability to transfer and eat) and the non-use of dentures among residents[24]. A descriptive study examined the relationship between untreated dental caries and functional status among 958 dentate nursing home residents aged 65 and over. The study found that 32% of residents had physical disability and 59% had dental diseases. The mean TAB scores for dentate and edentulous subjects were almost the same, indicating that both groups of subjects might have similar amount of disability or even this disability if present might not affect tooth loss. However, the mean TAB score for subjects who wear dentures is significantly higher than the scores for subjects who do not wear dentures (19.6 vs. 14.3, $p = 0.009$). This suggests that lower limb disability may affect the individual's ability for dental and prosthetic care utilisation. Also, physical disability was significantly related to untreated dental diseases[34]. However, previous studies did not use standardised and functional assessment to measure physical disability of upper and lower limbs[35]. In this study, we assessed the amount of physical impairments of the participants based on standard instruments such as the DASH and TAB. According to this result, physical impairment may have an effect on oral health of nursing home residents; however, some mouth problems are already existing before the appearance of disabilities. Therefore, future research should plan for longitudinal studies to investigate the effect of physical disabilities on oral health status.

The mean MMSE score (22.5) was significantly higher in dentate subjects compared to edentulous subjects (20.2) and was significantly higher in edentulous subjects who wear dentures compared to those who do not wear dentures (26.1 vs. 17.7). These results indicate that cognitive disabilities may have a negative effect on use of oral hygiene measures, such as brushing and flossing. This finding supports the conclusion of previous studies that cognitive impairments are associated with tooth loss, oral diseases and poor dental care utilisation[8–10,22,23,27,36]. However, these studies did

not use standardised assessment of cognitive function, which is not widely used in dental clinic[35]. In the current study, we attempted to avoid this shortcoming by assessing participants' cognitive function using the MMSE. Moreover, by including multiple other factors, we were able to adjust for age, smoking, education and diabetes. Education was an important confounding factor, and oral health may therefore be, at least to some extent, a marker of cognitive reserve (e.g. through a person's level of cognitive function present or acquired in early life influencing their oral self-care and subsequent oral health). Although diabetes, hypertension and smoking status are considered potential confounding factors, they alone did not significantly predict CAL over and above self-reported oral hygiene and upper limb disability. Taken together, this suggests that there is a need for caregivers in nursing homes to be actively involved in performing oral hygiene for individuals with poor upper limb strength. It should be noted that information on these factors was derived from a single examination and chronicity could not be taken into account. Moreover, potentially important factors that are affecting oral and periodontal health such as the amount of salivary flow, use of preventive care and baseline oral hygiene status were not included in the analysis.

The proportion of subjects with depression was slightly higher in edentulous subjects compared to dentate subjects (62.5 vs. 58.1%), and the mean GDS score was higher for subjects who do not wear dentures than subjects who do wear dentures (14.2 vs. 11.7); however, these result were not statistically significant. This may indicate that subjects with depression may be less likely to perform regular dental care. This finding is supported by previous studies indicating that depression may associate with advanced oral and dental diseases, disinterest in performing appropriate oral hygiene techniques, a cariogenic diet, diminished salivary flow and rampant dental caries[20,21,37,38]. For example, in a study sample of Australian older adults (>65 years), it was found that feeling depressed, were significantly and positively associated with increased reporting of oral health concerns in both males and females[39]. Moreover, the antidepressant and antipsychotic medications magnify Xerostomia and increase the incidence of dental diseases[20,21]. Appropriate dental management requires a vigorous dental education programme, adequate dental treatment and the use of saliva substitutes and anticaries agents containing fluoride[20,21,38].

Finally, this study has some potential limitations. First, the study sample has a wide age range, and nearly one-third of the study sample is under the age of 55. This could affect the results of this study because many nursing home samples in the literature focused on older adults. This sample age representation could be due to cultural, economical and traditional issues and rules related to nursing homes in this country. For example, in addition to older adults who cannot support themselves and have no familial support, there are other younger individuals who are placed in nursing homes. For example, unmarried young women without financial or family support are usually placed in nursing homes. Some young people with different disabilities (e.g. physical, mental) and without financial or family support are also residents in nursing homes. Second, the study focused on factors related to oral health status, such as physical and mental disabilities; however, there are many other factors relating to health that were not addressed in this study. Third, the study mainly focused on periodontal health and use of dentures as determinants of oral health status of subjects; however, individuals' oral health depend on other factors such as presence of caries, presence of missing teeth, number of filled teeth, etc.

Conclusion

Nursing home residents with a variety of physical, cognitive and psychological disabilities are at increased risk of deterioration of their oral health. Health professionals providing care to residents need to be aware of this and take appropriate preventive and therapeutic measures as needed. These results suggest that much can be done to improve the oral health of nursing home residents. The authors recommend that providing dental care services, medical treatments and rehabilitation services could yield improvements in oral health status. Nursing homes in Jordan currently have no dental care clinics and allied health services provided for their residents; this absence indicates the urgent need for these services in these homes. Efforts are needed to enhance access to dental and rehabilitation care for nursing home residents in Jordan. This study also acts as a reference for future intervention programmes in this field.

Acknowledgements

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