Comparison of Excessive Daytime Sleepiness between Complete Denture Wearers and Dentate Subjects Using Epworth Sleepiness Scale

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ABSTRACT

Objective: To compare excessive daytime sleepiness between complete denture wearers and dentate subjects among Jordanian norms using Epworth Sleepiness Scale.

Methods: A total of 107 Jordanian subjects were included in this cross-sectional study. They were randomly selected from the general population (dentate and complete denture wearers) who fulfilled objective diagnostic criteria and responded to a questionnaire. A validated, Arabic version of The Epworth Sleepiness Scale (ESS) was used to compare excessive daytime sleepiness between complete denture wearers and dentate subjects, gender and age differences were also investigated. The questionnaire asks the subject to rate his or her probability of falling asleep on a scale of increasing probability from 0 to 3 for eight different situations. Statistical analysis was performed using Student's t-test and One-way ANOVA to evaluate the differences in mean values of ESS between dentate and complete denture wearers in relation to gender and age. Level of significance was set at 0.05.

Results: The mean age of subjects was 54.61±12.41 (range 35-84 years), with mean ESS score of 9.51±4.83 (range 1-21). Fifty-nine (55.14%) participants were dentate and 48 (44.86%) were complete denture wearers, with mean ESS values of 5.81±2.21 and 14.06±2.88 respectively. Statistically significant differences were found in the age, and ESS scores between complete denture wearers and dentate subjects.

Conclusion: Elderly complete denture wearers had higher scores of excessive day-time sleepiness compared with dentate subjects.

Key words: Complete denture wearer, Dentate, Epworth Sleepiness Scale, Excessive daytime sleepiness, Sleep disorders.

JRMS September 2014; 21(3): 14-22 / DOI: 10.12816/0005522

Introduction

Sleep is a complex behavioral state necessary for neurological, somatic and psychological health; affected by the structural and functional condition of the brain.[1] Changes in sleep with normal aging can exacerbate other health issues, and the consequences of poor or inadequate sleep and excessive daytime sleepiness (EDS) are clearly detrimental to health.[2]

Prevalence rates for EDS in the general population have been estimated to range from

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Manuscript received September 19, 2012. Accepted February 7, 2013

0.3% to 13%.[3,4] Although EDS can be assessed objectively by means of the Multiple Sleep Latency Test,[5,6] The Pittsburgh Sleep Quality Index [7] or the Maintenance of Wakefulness Test;[8] these approaches are costy and time-consuming. The Epworth Sleepiness Scale (ESS) is the most commonly used subjective measure of EDS in the clinical and research settings, particularly with objective measures of sleep-disordered breathing.[9-11] It was introduced in 1991 by Dr Murray Johns of Epworth Hospital in Melbourne, Australia. It is a scale used to measure EDS, with both high specificity (100%) and sensitivity (93.5%),[12] by use of a very short questionnaire. It has been validated primarily in obstructive sleep apnea, though it has also shown success in detecting narcolepsy and idiopathic hypersomnia.[9]

The level of total tooth loss rises steeply with increasing age to the extent that approximately 40% of the middle aged and the vast majority of the elderly are edentulous.[13] As a consequence of increasing age and tooth loss, residual ridge resorption has become progressive throughout edentulous life,[14] in addition to anatomical changes that may impair upper airway size and function,[15,16] social isolation,[2] depressive illness and sleep disturbances.[17]

It has been reported that 78% of the elderly have EDS.[18] Sleepiness is not an inevitable consequence of aging and EDS in older people may be a consequence of medical condition, medications and undiagnosed sleep disorders associated with aging, thus, the underlying cause of that sleepiness should be diagnosed and treated.[19]

An association between edentulism and sleep disordered breathing was reported.[15,20] It is reported that 10% of elderly people may have obstructive sleep apnea as a result of edentulism.[21-23] Edentulous population had a significantly more backset maxilla and a shorter maxillary height compared to the dentate, this resulted in apnea/hypopnea syndrome which is worsened by complete edentulism.[20]

A significant association between sleep disordered breathing and complete denture use has also been reported.[24] Recent findings suggest that complete edentulism and sleeping without complete dentures favour disturbed sleep and sleep disordered breathing.[25,26] Gassino *et al*. showed that 71% of elders who did not wear their complete dentures at night were at high risk for sleep apnea.[21] Sleeping without complete dentures is associated with worsening of the apnea-hypopnea index and decreased antero-posterior oropharyngeal wall distance.[16,27] However, they reported that complete denture wearing over time changed the hyoid position due to changes in the mandibular and cervical inclination and significant reduction in anterior mandibular height.[28,29]

Emami *et al*.[26] reported that edentulous participants were not at risk for obstructive sleep apnea, and that healthy edentulous elders, independent of nocturnal wearing of their complete dentures, are quite good sleepers. In addition, daytime complete denture wearing had no influence on the rate of residual ridge resorption.[30] In contrast to Arisaka *et al*. [22] who reported that wearing complete dentures during sleep improves the apnea/hypopnea index in most edentulous obstructive sleep apnea patients. Almeida *et al*. reported that complete denture-wearing during sleep significantly increases the apnea/hypopnea index.[23]

The importance of this study comes from the fact that studies investigating the sleep quality of edentulous complete denture wearer elders are scarce and, to the authors' knowledge, no study has compared EDS between complete denture wearers and dentate subjects as previous studies especially those considering the effect of age on ESD are not valid for Jordanian population. Thus, the present study was conducted to obtain baseline information on the sleep quality and EDS of a population of complete denture-wearing elders and to test the hypothesis that there is a significant difference in EDS between complete denture wearers and dentate subjects. Therefore, the aim of this study was to compare EDS between edentulous complete denture wearer elders and dentate subjects with full set of natural teeth in relation to gender and age, among subjects of Jordanian populations using ESS.

Method

This study was carried out at the Prosthodontic Clinic, Department of Dentistry, Prince Hashim Bin Al-Hussien Hospital in Zarka, Jordan over a six months period from November 2011 to May 2012.

The sample was selected from a general population of completely edentulous, and complete denture wearers and dentate subjects who attended (or referred to) the Prosthodontic and General Dental Practitioner clinics.

Inclusion/Exclusion Criteria:

Adult subjects of either gender with different age groups (completely edentulous, complete denture wearers and fully dentates with full set of natural teeth with the exclusion of third molars) who will be able to understand and respond to questionnaires used in the study and willing to accept the protocol and give informed consent will be included. Exclusion criteria are subjects with history of chronic anxiolytic/sedative drug use, associated respiratory, renal, hepatic or cardiovascular disease, or upper respiratory tract infection within the past two weeks, as well as those who are pregnant or critically ill. In addition, all completely edentulous non-denture wearers and partially dentate subjects have been excluded.

A cross-sectional study was conducted for all patients who met the inclusion criteria and provide verbal informed consent. This study was approved by the Higher Ethical Committee at the Royal Medical services, represented by the Head of the Dental Specialties of the Department of Dentistry in the Royal Medical Services. The study sample comprises 107 participants with a mean age 54.61 (±12.41) years (ranged between 35 and 84 years). Of these, 59 dentate and 48 complete denture wearers were selected and accepted to participate in this study.

All recruited patients were subjected to answer a specially designed questionnaire concerning the patient's demographic data including age, gender, medical insurance number, occupation and place of residence. Clinical examination of complete denture wearers was carried out by a Prosthodontist while that for dentate subjects was performed by an Orthodontist.

Questionnaire

The Epworth Sleepiness Scale was developed by Johns as a simple, self-administered questionnaire, to assess sleep propensity.[9] It has been shown that ESS is reproducible[31] valid.[32] The Arabic version has also been validated.[33] The questionnaire asks the subject to rate his or her probability of falling asleep on a scale of increasing probability from 0 to 3 (0 = no chance of dozing, 1 = slight chance of dozing, 2 = moderate chance of dozing, 3 = high chance of dozing; minimum score = 0, maximum score = 24) for eight different situations that most people engage in during their daily lives, though not necessarily every day. The scores for the eight questions are added together to obtain a single number. A number in the 0–9 range is considered to be normal while a number in the 10–24 range indicates that expert medical advice should be sought. For instance, scores of 11-15 are shown to indicate the possibility of mild to moderate OSA, where a score of 16 and above indicates the possibility of severe OSA or narcolepsy. Certain questions in the scale were shown to be better predictors of specific sleep disorders, though further tests may be required to provide an accurate diagnosis.

Statistical analysis

Statistical analysis was performed using SPSS Statistic Version 17 (SPSS Corporation, Chicago, IL, USA). One-sample student's t-test was used to evaluate the differences in mean values of ESS between dentate and complete denture wearers in both genders. Paired t-test was further used to determine whether there were gender differences in the mean values of the two groups. One-way ANOVA was used to study the association between and within dentate and complete denture wearers groups. Ninety-five percent confidence intervals about the mean were constructed for differences between dentate and complete denture wearer group and male and female participants. Level of significance was set at 0.05.

Results

The mean age of study sample was 54.61 (±12.41) and ranged between 35 and 84 years. Mean ESS score was 9.51 (±4.83) and ranged between 1 and 21 on the scale. Of these, there were 59 (55.14 %) dentate and 48 (44.86 %) complete denture wearers, with mean scores of ESS of 5.81 (±2.21) and 14.06 (±2.88); respectively. Mean and SD values of ESS and age of participants distributed according to dental status (complete denture wearers and dentate subjects) and between genders are shown in Table I.

Table I: Mean and SD values of ESS and age of subjects according to dental status (Complete denture wearer/Dentate) and between genders

			Age			ESS		
	n	%	Mean	SD	Range	Mean	SD	Range
Male dentate	27	25.23	49.96	10.94	36-70	5.67	2.73	1-10
Female dentate	32	29.91	50.34	11.07	35-73	5.94	1.68	2-9
Male complete denture wearer	22	20.56	62.59	13.08	39-84	13.82	3.10	11-21
Female complete denture wearer	26	24.30	57.92	10.90	38-75	14.27	2.74	10-19
Dentate (total)	59	55.14	50.17	10.92	35-73	5.81	2.21	1-10
Complete denture wearer (total)	48	44.86	60.06	12.05	38-84	14.06	2.88	10-21
Male (total)	49	45.79	55.63	13.41	36-84	9.33	5.00	1-21
Female (total)	58	54.21	53.74	11.54	35-75	9.67	4.72	2-19
Total	107	100%	54.61	12.41	35-84	9.51	4.84	1-21

SD: Standard deviation; n: number

Table II: Differences in the mean values of age of participants according to dental status and between genders (Paired Student's t-Test)

	Paired Differences					t	df	P value
				95% Confidence Interval of the Difference				
	Mean	SD	Std. Error Mean	Lower	Upper			
Male dentate - Female dentate	-0.44	17.22	3.31	-7.26	6.37	-0.134	26	0.89 (NS)
Male complete denture wearer - Female complete denture wearer	5.64	15.74	3.36	-1.34	12.61	1.68	21	0.19 (NS)
Total dentate - Total complete denture wearer	-9.31	13.87	2.00	-13.34	-5.29	-4.65	47	0.000
Total male - Total female	2.43	18.29	2.61	-2.82	7.68	0.930	48	0.36 (NS)

SD: standard deviation; NS: not significant

Statistically significant difference (P=0.000; Paired Student's t-test) was recorded in the age between complete denture wearers and dentate subjects. However, no other differences were found between genders (P=0.357) and in subgroups as well (Table II).

A one-sample student's t-test was used to evaluate the differences in mean values of ESS between dentate and complete denture wearers in both genders. The table shows that complete denture wearers have a mean value of ESS of approximately three times compared to dentate subjects. However, in the other groups, the mean values seem very close (Table III).

Statistically significant difference (P=0.000; Paired Student's t-test) was recorded in the ESS between complete denture wearers and dentate subjects (in total); and between males and between females in the two groups. However, no other differences were found between genders in dentate subjects (P=0.638) and in complete denture wearers (P=0.925) and no gender differences as a whole (Table IV).

One-way ANOVA was used to reveal any differences in the mean values of ESS of participants between and within dentate and complete denture wearer groups in relation to gender. A statistically significant difference (P=0.01) was recorded in the ESS between complete denture wearers and dentate subjects (in total); and between males (P=0.013) and between females (P=0.019) in the two groups. However, the other differences were found insignificant (Table V).

Discussion

Excessive daytime sleepiness is characterized by persistent sleepiness, even after apparently adequate sleep. Therefore, this study was conducted to compare EDS between complete denture wearers and dentate subjects using ESS. Differences in EDS between the two groups should be considered when dealing with patients who seek dental treatment, as this factor has not received much attention in the literature. Besides several important factors such as age and gender

Table III: One-sample Student's t-test of the mean values of ESS of participants distributed according to dental status and between genders

	Test Value = 0					
	t	df	Mean Difference	Std. Error Mean	95% Confidence Interval of the Difference	
					Lower	Upper
Male dentate	10.78	26	5.67	0.53	4.59	6.75
Female dentate	19.95	31	5.94	0.30	5.33	6.54
Male complete denture wearer	20.94	21	13.82	0.66	12.45	15.19
Female complete denture wearer	26.60	25	14.27	0.54	13.16	15.37
Total dentate	20.22	58	5.81	0.29	5.24	6.39
Total complete denture wearer	33.79	47	14.06	0.42	13.23	14.90
Total Male	13.05	48	9.33	0.71	7.89	10.76
Total Female	15.60	57	9.67	0.62	8.43	10.91

Table IV: Differences in the mean values of ESS of participants according to dental status and between genders. (Paired Student's t-Test)

	Paired Differences					t	df	P value
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Male dentate - Female dentate	-0.30	3.23	0.62	-1.57	0.98	-.476	26	0.64 (NS)
Male complete denture wearer- Female complete denture wearer	0.091	4.48	0.96	-1.90	2.08	0.095	21	0.93 (NS)
Total dentate - Total complete denture wearer	-8.25	3.68	0.53	-9.32	-7.18	-15.53	47	0.000
Total Male - Total Female	0.63	4.14	0.59	-0.56	1.82	1.07	48	0.29 (NS)
Male dentate - Male complete denture wearer	-8.36	3.86	0.82	-10.08	-6.65	-10.16	21	0.000
Female dentate - Female complete denture wearer	-8.38	3.19	0.63	-9.67	-7.10	-13.41	25	0.000

NS: not significant

Table V: Differences in the mean values of ESS of participants according to dental status and between genders (One-way ANOVA table)

One-way ANOVA		Sum of Squares	df	Mean Square	F-ratio	P value
Male Dentate BY Female Dentate	Between Groups	29.89	7	4.27	0.49	0.83
	Within Groups	164.11	19	8.64		(NS)
	Total	194.00	26			
Male complete denture wearer BY Female DW	Between Groups	100.94	8	12.62	1.64	0.21
	Within Groups	100.33	13	7.72		(NS)
	Total	201.27	21			
Total dentate BY Total complete denture wearer	Between Groups	39.12	10	3.91	0.65	0.010
	Within Groups	222.20	37	6.01		
	Total	261.31	47			
Total Male BY Total Female	Between Groups	653.53	15	43.57	2.63	0.76
	Within Groups	547.25	33	16.58		(NS)
	Total	1200.78	48			
Male dentate BY Male complete denture wearer	Between Groups	54.24	9	6.03	0.67	0.013
	Within Groups	107.22	12	8.94		
	Total	161.46	21			
Female dentate By Female complete denture wearer	Between Groups	13.99	9	1.55	0.42	0.019
	Within Groups	58.67	16	3.67		
	Total	72.65	25			

NS: not significant

should be considered as they might influence the degree of sleeping disorders.

Excessive daytime sleepiness was determined using ESS, which has been used in many studies.[2,9,20,26,34-40] It is an eight item self-administered questionnaire validated in obstructive sleep apnea, narcolepsy, and idiopathic hypersomnia.[9,41] It was defined using a standard cut-point of ESS ≥ 10.[42] In the study, the mean ESS was 9.51 and approximately 45% of subjects had ESS higher than 10 (ESS in complete denture wearers=14.06), however, Ronksley *et al*.[43] reported that 66.0% of subjects had EDS (ESS ≥ 10); also, Almeida *et al.*[23] reported that 50% of complete denture wearers had EDS.

Statistically significant differences (P=0.000, 2-tailed Student's t-test) in the mean values of ESS between complete denture wearers (14.06±2.88) and dentate subjects (5.81±2.21) might be attributed to the adverse effects of complete denture wearing which favours airway obstruction causing obstructive sleep apnea which is associated with EDS besides the effects of age and general health status.

The mean age of study sample was 54.61 (±12.41), ranged between 35 and 84 years; complete denture wearers were approximately 10 years older than dentate subjects and a statistically significant difference (P=0.000; Student's t-test) was recorded in the mean age between the two groups (60.06± 12.05 and 50.17±10.92; respectively). Sleep disordered breathing causes symptoms of EDS and disturbed sleep at night in the elderly and its prevalence is greater among the elderly than among younger adults.[34,40] Several factors associated with ageing contribute to or cause sleep disturbances in elderly populations such as medical and psychiatric diseases, medication, circadian rhythm disturbances, changes in lifestyle and age-related anatomical modifications.[18]

Approximately one-fourth of the study sample was above the age of 65 years, of these 37.50% were complete denture wearers and 13.65% were dentate elderly subjects. A previous study showed that problems with sleep and EDS are common with advancing years and occur in over half of adults age 65 and older.[18] However, it has been reported that sleepiness is not an inevitable consequence of aging and suggested instead that EDS in older people may be a consequence of medical conditions, medications, and undiagnosed sleep disorders associated with aging.[19] Moreover, it was shown that the most commonly reported sleep-related complaints were difficulty sleeping (45%), snoring (33.3%) and EDS (27.1%).[44] In addition, it was reported that older patients presenting to their physician with the symptoms of EDS should be diagnosed and treated for the underlying cause of that sleepiness.[45]

The response of some older people to acute sleep deprivation can be comparable with or even better than that of younger adults.[46] Many older adults, unlike the healthy participants in the current study, take medications or have medical conditions that disrupt sleep, leading to EDS. However, all subjects included in this study had no underlying disease and/or taking no medication that might affect sleep, but this did not mean that many of them might have undiagnosed sleep disordered breathing which can disrupt sleep, leading to EDS.

The role of gender has not been extensively investigated in the literature. However, several studies reported an association of different aspects of craniofacial form with obstructive sleep apnea in different racial groups,[27,28,47,48] head posture,[29,48] airway size [49] and neck circumference. [50] In addition, it has been postulated that the presence of cognitive impairment, [35] snoring,[27] Alzheimer's dementia,[34] depression,[38] hypertension, insomnia and age,[2,40,50] obesity,[48,51,52] and diabetes mellitus[43,53] were associated with EDS.

It is estimated that 4% of middle-aged men and 2% of middle-aged women in the general population had obstructive sleep apnea.[54] In this study, females had slightly higher ESS value compared to males (9.67±4.72 and 9.33 ±5.00; respectively) but the differences were not statistically significant (p=0.290, paired student's t-test). Of these, 55.14% of subjects were dentate, with mean age of 50.17(±10.92) and 44.86% were complete denture wearers. In both groups, Females had slightly higher ESS value compared to males, however, the difference was statistically insignificant (p=0.638 in dentates; p=0.925 in complete denture wearers; Paired Student's t-test). These findings have shown that gender per se is not affecting EDS. Tsuno *et al*.[38] have

recently shown that over 65 years old, men were significantly more likely to report EDS (ESS score>10) compared to women (12.0% versus 6.0% respectively).

Several studies had shown associations between edentulism and EDS and other sleep disordered breathing. [15,20-26,39] The edentulous patients tend to experience obstructive sleep apnea at a higher incidence than that of the general population.[27,28] Anatomical changes associated with edentulism such as decrease in the vertical dimension of occlusion, change in the position of the mandible and the hyoid bone and impaired function of the oropharyngeal muscles lead to sleep disordered breathing.[16,20,39,48,49.55]

Some studies reported a significant association between sleep disordered breathing and complete denture use.[16,24,27] Complete denture replacement helps raising the vertical dimension of occlusion and improves the function of masticatory and oropharyngeal muscles, consequently help reducing obstructive sleep apnea, EDS and other sleep disordered breathing.[21,23,39] However, our findings showed that the mean value of ESS in complete denture wearers was significantly higher than that in dentate subjects and that complete denture wearers had more EDS compared with dentate subjects. It seems clear that wearing complete dentures did not improve EDS. These findings are supported in a previous study.[22] Research on EDS has grown tremendously in recent years, however, and to the authors' knowledge, none of these compared between complete denture wearers and dentate subjects. In this study, the differences in ESS values were statistically significant between complete denture wearers and dentate subjects, these findings were confirmed by significant differences within group of men (p=0.013; One-way ANOVA) and women (0.019; One-way ANOVA) in dentate compared to complete denture wearers.

The current study confirmed that edentulous, complete denture wearers had EDS disorder and were at higher risk of obstructive sleep apnea in spite of complete denture wearing. The mean ESS scores in this population were higher than those previously reported in a dentate population. However, these findings were different from those reported in previous studies.[9,26]

To date, several studies have investigated the EDS in complete denture wearers and the observed results are mixed.[16,20,21,24,26,27,30,39,43] These inconsistent findings can be attributed to differences in sample composition as well as clinical determination of EDS, quality of life measures that differ in content and precision, chosen statistical procedure, inconsistent adjustment of important confounding variables.

The participants were selected from the general population, they were healthy with no history of medical condition and/or medication that might influence sleep or cause any sleep disorder, however medical conditions have not been investigated, so a further research is needed to evaluate the effect of medical diseases on EDS among elderly complete denture wearers.

In this study, age and gender were the only factors considered and compared, since EDS has an independent impact on some aspects of quality of life, other important factors such as comparison between edentulous, complete denture wearers and non-denture wearers, differences in body mass index, and socioeconomic status were not investigated. Further research on a larger sample and including other factors such as local and systemic factors, complete denture quality measures, general health status and wider age range may be needed before the results of this study can be generalized. In addition, other studies to assess the masticatory muscle activity and jaw opening in a larger sample of edentulous patients with EDS are suggested to help better understand the effects of complete dentures on sleep parameters.

Conclusions

The results of this study suggest that healthy complete denture wearer elders have significantly higher scores of ESS compared to dentate subjects with no apparent gender differences. Complete denture wearing has a role in the occurrence or the aggravation of excessive daytime sleepiness, and its negative impact may influence sleep quality. Further investigations are needed to explore these findings.

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