

# Influence of Geriatric Depression on Oral Health-related Quality of Life in the Urban Elderly Population: A Study from Southern Indian

DEEPA PONNAIYAN<sup>1</sup>, HARINATH PARTHASARATHY<sup>2</sup>, DHAYANAND JOHN VICTOR<sup>3</sup>

## ABSTRACT

**Introduction:** Depression causes a lot of Problems which leads to decreased quality of life and increased mortality in elderly. It is necessary to assess the relationship between geriatric depression and its impact on Oral Health-Related Quality of Life (OHRQoL).

**Aim:** To determine the association between geriatric depression and OHRQoL in older adult southern Indian population.

**Materials and Methods:** Two hundred and thirty subjects aged 60 years and older, attending outpatient department of SRM Dental College, Chennai, Tamil Nadu, India were recruited for the study. Geriatric Depression Scale (GDS) -15 and Oral Health Impact Profile (OHIP) -14 was recorded. Decayed Missing Filled Teeth (DMFT) index was used to ascertain the dental treatment needs of subjects. Data were collected using self or interviewer-administered questionnaires. Data were analysed using descriptive statistics. To compare proportions between GDS score groups Chi-Square test was applied. Uni variate and multi variate logistic regression analysis was done to

estimate the Odds ratios of the factors associated with Geriatric depression.

**Results:** The prevalence of depression according to GDS-15 was 56.5% (130) out of which 47.4% (109) were suffering from mild depression (GDS 5-9) and 9.1% had severe depression (GDS 10-15). The oral health impact profile was significantly associated with depression ( $p < 0.001$ ). Socio-demographic characteristics like presence of systemic diseases ( $p = 0.002$ ), smoking and alcohol consumption ( $p < 0.001$ ), marital status ( $p = 0.001$ ), education ( $p = 0.024$ ), family circumstances ( $p = 0.001$ ) were also significantly associated with depression. Subjects with poor oral hygiene had odds ratio of 1.79 when correlated with GDS score  $> 5$ .

**Conclusion:** These present results indicate that there is a strong correlation between GDS and OHIP-14. The presence of geriatric depression affects the overall oral health related quality of life. Intervention programs of oral health promotion and routine screening for detecting early signs of depression are essential in urban elderly population.

**Keywords:** Ageing, Mental disorders, Older adults

## INTRODUCTION

Ageing is inevitable and defined as a period in which people become biologically and socially dependent [1]. Moreover, the elderly population become economically unproductive are often neglected and lonely. As a result, they are prone to mental disorders of which depression is predominant. Depression is a silent epidemic and according to World Health Organisation (WHO), depression is projected to be second leading cause of disease burden worldwide by 2020 and first by 2030 [2,3]. Characterised by sadness, loss of interest or pleasure, feelings of guilt or low self-esteem, disturbed sleep or appetite, fatigue and poor concentration, depression is a common mental disorder that puts constraints on quality of life among older adult individuals [4]. Apart from affecting general health, geriatric depression also affects oral health and might cause a public health challenge [3]. The prevalence of depression among older adults has been reported to be 5.1% in Mexico [5], 3.6% in the United States [6] and 19.8-33.5% in four Japanese communities [7]. Community-based cross-sectional studies in India on geriatric urban population have revealed prevalence of depression to be 15.1% [8], 29.3% [9] and 31.5% [10] respectively. However, in rural India higher prevalence of depression has been reported ranging from 6.2% - 47% [11,12], 42.7% [13] and 37.8% [14].

It is necessary to assess the relationship between geriatric depression and its impact on oral health quality of life. Literature evidence suggests depression has a negative impact on OHRQoL [15,16]. Studies on geriatric Brazilian population revealed that

individuals with depression are more likely to have poor OHRQoL as well as negative impact on general health [17-21]. In Chinese and Korean community-dwelling elders, it has been observed that a negative correlation exists between geriatric depression and oral health promoting behaviour [22,23]. Recently, Yamamoto T et al., observed oral health status might play a role in development or worsening of depressive symptoms [24]. Dable RA et al., found an increase in OHRQoL after dental rehabilitation among geriatric edentulous subjects in western India [25]. Similarly, Raja BK et al., observed a strong positive correlation between the sense of coherence in elders and OHQRoL [26].

GDS is a premium diagnostic instrument which is simple, easy to use tool to screen for depression, GDS-15 by Sheikh JL and Yesavage JA, incorporating 15 questions were used [16]. The OHIP-14 a patient-centred, tool was used for the measurement of OHRQoL [19].

It is essential to assess the magnitude and scope of depression in older adults and its impact on their OHRQoL including subjects living at home, who are in ambulatory care and subjects who receive care in homes by health professionals. To the authors' knowledge, there have been no studies assessing the relationship between geriatric depression and its effect on OHQRoL in Indian population. The purpose of this study was to ascertain the prevalence of depression and examine the association between geriatric depression and OHRQoL in older adults from an urban Southern Indian population residing in Chennai, Tamil Nadu, India.

## MATERIALS AND METHODS

The present cross-sectional study was carried out between September 2016 to January 2017 among individuals aged 60 years and older who attended the outpatient Department of Periodontics, SRM Dental College, Ramapuram, Chennai, Tamil Nadu, India. A total of 230 male and female subjects were recruited. Prior to the beginning of the research, informed consent was obtained from the subjects and the data collection method was approved by the Ethical Committee of SRM University (SRMDC/IRB/2015).

The inclusion criteria were patients aged 60 and above. Patients with known history of psychiatric disorders, severe abnormality in speech and hearing and cognitive impairment were excluded since these will affect the true assessment of depression. The Type 1 error probability ( $\alpha$ ) was set at 0.1 level. For these assumptions, the minimum sample size was 207. We anticipated a 10% drop out and therefore the projected sample size was set at 230.

The subjects were invited to fill a questionnaire during their regular dental check-up [Table/Fig-1]. The data regarding number of teeth, caries experience (DMFT) and oral hygiene status was then recorded by clinical examination. All investigations were carried out by two trained calibrated examiners. Mean kappa index for inter examiner agreement=0.90.

Name:	Age:	Sex:	Education:
Marital status:	Religion:	Address:	Employment status:
Monthly income:	Have you been to dentist before? Yes/No	Do you wish to replace your missing teeth? Yes/No	Do you wish to fill your teeth? Yes/No
Any chronic disease? Specify	Smoking? Yes/No	Alcohol consumption? Yes/No	Living alone/ living with family?

[Table/Fig-1]: Demographic data questionnaire.

To assess the severity of depression Yesavage's GDS shorter version, a 15 question instrument consisting of questions related to how the subject feels over the past 1 week was used to assess depression. A score of 0 to 4 is considered as absence of depression, score of 5 to 9 suggests the presence of mild depression. The score of 10 or above suggests severe depression [15].

### Measures

Geriatric Depression Scale-short form (GDS-15) is a brief 15-item instrument validated as a screening tool for depression based on self-reported feelings over the past 1-week [16]. "Yes" response to negatively worded questions and "No" response to positively worded questions are given a score of one. The scale has been utilised in the clinical as well as research setting [11]. A validated Tamil GDS short form was used for the study [12].

The subjective oral health instrument used for this present study was the OHIP-14. A validated Tamil OHIP 14 scale was used in the present study [27]. It aims to assess seven dimensions of impacts of oral conditions on people's OHRQoL including functional limitation, physical pain, psychological discomfort, physical disability, psychological disability, social disability and handicap over a period of one year. The questions were regarding whether you have trouble in pronouncing words, if sense of taste has worsened, painful aching in the mouth and discomfort while eating food. Tensed or have problems with teeth/ gums or denture. Any limit in the kind or amount of food, tensed or find life less satisfying because of problems with your teeth/ gums or denture. The functional and psychosocial impact of problems with teeth, dentures and mouth are assessed by each item and scored as never, hardly ever, occasionally, often and very often. This is assessed for a period of one year [28,29].

The response to each question in the OHIP questionnaire is given a number ranging from 0 to 4. This was done according to the scoring criteria for the OHIP index as given by Slade GD [18]. The response to each question is then totalled and the scores are added for all

the 14 questions that are denoted as the cumulative OHIP score or OHIP-ADD score which is maximum of 56.

## STATISTICAL ANALYSIS

Characteristics of the study participants are presented as 95% Confidence Intervals (CI), or means and Standard Deviation (SD). To compare the mean values between GDS score groups one-way ANOVA was applied followed by Tukey's HSD post-hoc tests for multiple pairwise comparisons. To compare proportions between GDS score groups Chi-Square test was applied, if any expected cell frequency was <5 then Fisher's-exact test was used. Univariate and multivariate logistic regression analysis was done to estimate the Odds ratios of the factors associated with Geriatric depression based on that the confounding variables were eliminated. The relationship between GDS-SF scores and OHIP-14 scores was estimated after adjusting for socio-demographic characteristics and health related behaviours. SPSS version 22.0 was used to analyse the data. Significance level was fixed as 5% ( $\alpha=0.05$ ).

## RESULTS

Socio-demographic and clinical characteristics of the 230 subjects are presented in [Table/Fig-2], women comprised 44.3% of participants

Characteristics	Category	Number (%)
Sex	Male	128 (55.7)
	Female	102 (44.3)
	Total	230 (100.0)
Habits	None	134 (58.3)
	Tobacco	58 (25.2)
	Alcohol	9 (3.9)
	Tobacco+Alcohol	29 (12.6)
Total	230 (100.0)	
Denture	Not wearing denture	176 (76.5)
	Partial	49 (21.3)
	Complete	5 (2.2)
	Total	230 (100.0)
Systemic Disease	Systemically healthy	84 (36.5)
	Diabetes mellitus	51 (22.2)
	Hypertension	37 (16.1)
	Diabetes mellitus and hypertension	24 (10.4)
	Others	34 (14.8)
Total	230 (100.0)	
Education	Illiterate	73 (31.7)
	Primary	30 (13.0)
	Secondary	64 (27.8)
	Graduate	63 (27.4)
	Total	230 (100.0)
Marital status	Unmarried	9 (3.9)
	Married	121 (52.6)
	Separated/divorced	26 (11.3)
	Widowed	74 (32.2)
Total	230 (100.0)	
Employment	Never employed	85 (37.0)
	Employed	81 (35.2)
	Retired	64 (27.8)
	Total	230 (100.0)
Dependency	Living with family	81 (35.2)
	Old age home	114 (49.6)
	Living alone	35 (15.2)
	Total	230 (100.0)

[Table/Fig-2]: Socio-demographic characteristics of study subjects (n=230).

(N=102). Approximately, 35.2% of participants were employed at the time of the study. A total of 25.2% of participants were smokers and 31.7% were illiterate. Regarding family circumstances, 32.2% were living without a spouse and 49.6% were living in an old age home. 10.4% (24) were both diabetic and hypertensive and 2.2% (5) were completely edentulous.

In the present study, the prevalence of depression according to GDS was 56.5% (130), of which 47.4% (109) were suffering from mild depression (GDS 5-9) [Table/Fig-3]. The socio-demographic characteristics when correlated with severity of depression, it was observed that there was a strong correlation between habits, marital status and family circumstances ( $p<0.001$ ). Presence of chronic diseases and education status was also significant to the severity of depression ( $p=0.002$  and  $p=0.024$ ). The oral hygiene status, overall caries experience (DMFT) and the willingness for dental treatment were also highly significant to the severity of depression ( $p<0.001$ ) [Table/Fig-4].

Depression severity per GDS score	Number	%
Absent (0-4)	100	43.5
Mild (5-9)	109	47.4
Severe (10-15)	21	9.1

**[Table/Fig-3]:** Prevalence of depression according to GDS 15 scores (n=230).

Characteristic		Depression absent (0-4) Number (%)	Depression mild (5-9) Number (%)	Depression severe (10-15) Number (%)	p-value
Age (Years)	60-64 yrs	37 (46.8)	35 (44.3)	7 (8.9)	0.680
	65-69 yrs	27 (40.9)	35 (53.0)	4 (6.1)	
	>70 yrs	36 (42.4)	39 (45.9)	10 (11.8)	
Sex	Male	58 (45.3)	59 (46.1)	11 (8.6)	0.812
	Female	42 (41.2)	50 (49.0)	10 (9.8)	
Habits	Smoker	23 (39.7)	28 (48.3)	7 (12.1)	<0.001
	Alcoholic	2 (22.2)	5 (55.6)	2 (22.2)	
	Smoker and alcoholic	5 (17.2)	17 (58.6)	7 (24.1)	
Systemic diseases	Diabetes mellitus	15 (29.4)	28 (54.9)	8 (15.7)	0.002
	Hypertension	13 (35.1)	20 (54.1)	4 (10.8)	
	Diabetes mellitus and hypertension	8 (33.3)	14 (58.3)	2 (8.3)	
Education	Illiterate	21 (28.8)	41 (56.2)	11 (15.1)	0.024
	Primary	14 (46.7)	14 (46.7)	2 (6.7)	
	Secondary	28 (43.8)	32 (50.0)	4 (6.3)	
	Graduate	37 (58.7)	22 (34.9)	4 (6.3)	
Marital status	Unmarried	2 (22.2)	6 (66.7)	1 (11.1)	0.001
	Married	77 (63.3)	39 (32.2)	5 (4.1)	
	Separated/divorced	4 (15.4)	16 (61.5)	6 (23.1)	
	Widowed	17 (23.0)	48 (64.9)	9 (12.2)	
Family circumstances	Living with family	55 (67.9)	23 (28.4)	3 (3.7)	0.001
	Old age home	42 (36.8)	67 (58.8)	5 (4.4)	
	Living alone	3 (8.6)	19 (54.3)	13 (37.1)	
Oral hygiene status	Good	11 (91.7)	1 (8.3)	0 (0)	0.001
	Fair	66 (58.4)	44 (38.9)	3 (2.7)	
	Poor	23 (21.9)	64 (61.0)	18 (17.1)	
Willing for dental treatment	Yes	73 (56.2)	49 (37.7)	8 (6.2)	0.001
	No	27 (27.0)	60 (60.0)	13 (13.0)	
DMFT index	Overall score	100 (6.57)	109 (9.79)	21 (12.81)	0.001

**[Table/Fig-4]:** Socio-demographic characteristics, oral hygiene and depression (n=230).

In the present study, the correlation between oral health quality of life and severity of geriatric depression score are presented in [Table/Fig-5]. The mean OHIP-ADD score was highest in subjects with severe depression (GDS 10-15) and least in subjects without depression (GDS<5). The OHIP-ADD score strongly correlated with the severity of depression ( $p<0.001$ ). The individual OHIP items involving functional limitations and physical pain was highly significant to the severity of depression exhibiting higher scores for these domains ( $p<0.001$ ). Subjects with severe depression experienced greater psychological discomfort ( $4.41\pm 2.61$ ) and psychological disability ( $4.09\pm 2.6$ ). Physical disability was more in subjects with severe depression ( $4.9\pm 2.3$ ). Social disability and social handicap scores were higher in subjects with severe depression. All the 7 domains of the OHIP were highly significant to the severity of geriatric depression suggesting that the subjects with geriatric depression have an overall poor OHRQoL.

Variables	GDS score	Mean OHIP score $\pm$ SD	p-value
OHIP ADD score	Absent (0-4)	11.8 $\pm$ 9.2	<0.001
	Mild (5-9)	24.1 $\pm$ 11.2	
	Severe (10-15)	30.6 $\pm$ 11.7	
Functional limitation	Absent (0-4)	1.8 $\pm$ 2.2	<0.001
	Mild (5-9)	3.7 $\pm$ 2.8	
	Severe (10-15)	3.7 $\pm$ 2.2	
Physical pain	Absent (0-4)	2.6 $\pm$ 2.2	<0.001
	Mild (5-9)	4.1 $\pm$ 2.0	
	Severe (10-15)	5.2 $\pm$ 1.8	
Psychological discomfort	Absent (0-4)	1.3 $\pm$ 1.5	<0.001
	Mild (5-9)	3.1 $\pm$ 2.0	
	Severe (10-15)	4.4 $\pm$ 2.6	
Physical disability	Absent (0-4)	1.9 $\pm$ 2.0	<0.001
	Mild (5-9)	3.6 $\pm$ 2.3	
	Severe (10-15)	4.9 $\pm$ 2.3	
Psychological disability	Absent (0-4)	1.7 $\pm$ 1.8	<0.001
	Mild (5-9)	3.4 $\pm$ 2.04	
	Severe (10-15)	4.0 $\pm$ 2.6	
Social disability	Absent (0-4)	1.3 $\pm$ 1.6	<0.001
	Mild (5-9)	3.3 $\pm$ 2.0	
	Severe (10-15)	4.1 $\pm$ 2.2	
Handicap	Absent (0-4)	0.9 $\pm$ 1.3	<0.001
	Mild (5-9)	2.8 $\pm$ 2.4	
	Severe (10-15)	3.8 $\pm$ 2.8	

**[Table/Fig-5]:** Association between Geriatric Depression Score (GDS) and Oral Health Impact Profile (OHIP).

The final multinomial regression model for the overall sample to identify socio-demographic and oral hygiene related variables associated with geriatric depression (GDS $\geq$ 5) was depicted. The factors that were likely to be associated with depression were correlated by the odds ratio [Table/Fig-6]. The Individuals living alone were more likely to be depressed with an odds ratio of 12.4 (95% CI; 3.9-60.6;  $p=0.001$ ). Individuals with poor oral hygiene had odds ratio of 1.8 (95% CI; 1.79-184.7;  $p=0.014$ ) and subjects who were not willing for dental treatment was not significantly associated with GDS scores  $>5$ , odds ratio of 1.12 (95% CI; 0.49-2.53;  $p=0.787$ ) respectively.

## DISCUSSION

The present study investigated the relationship between geriatric depression and OHRQoL in an urban geriatric population residing in Chennai, India. The results demonstrated that the prevalence of depression in the present study population to be 56.5% with 9.1% suffering from severe depression which could be attributed

Factors	Number (%) GDS ≥5	Un adjusted or (95% CI)	p-value	Adjusted or (95% CI)	p-value
<b>Family circumstances</b>					
Living with family	26 (32.1)	1.0		1.0	
Old age home	72 (63.2)	3.63 (1.9-6.6)	0.001	2.63 (1.27-5.44)	0.009
Living alone	32 (91.4)	22.5 (6.3-80.5)	0.001	12.4 (3.9-60.6)	0.001
<b>Oral hygiene index</b>					
Good	1 (8.3)	1.0		1.0	
Fair	47 (41.6)	7.83 (0.9-62.7)	0.053	6.61 (0.67-64.9)	0.105
Poor	82 (78.1)	39.22 (4.81-319.8)	0.001	1.79 (1.79-184.7)	0.014
<b>Willing for dental treatment</b>					
Yes	57 (43.8)	1.0		1.0	
No	73 (73.0)	3.46 (1.9-6.07)	0.001	1.12 (0.49-2.53)	0.787

**[Table/Fig-6]:** Logistic Regression Analysis to identify factors associated with Geriatric depression (GDS Score ≥5).

to the varied socio-demographic characteristics of subjects like living conditions, employment and presence of chronic diseases. These factors have been previously reported to be associated with depression [8,30].

The severity of geriatric depression was significantly associated with systemic diseases, education status and marital status. Family circumstances had highest impact on depression as observed by the logistic regression analysis with odds ratio of 12.4 (3.9-60.6; p=0.001). This finding was similar to studies in older adult rural population in India where mild depression was associated with education status and living circumstances in elderly [9,13,31]. The oral health status was significantly associated with severity of depression with 78.1% of subjects with depression found to have poor oral hygiene and similarly 73% of subjects with depression were not willing for dental treatment and reported a high DMFT score (decay, missing, filled treatment) suggesting that depression reduces the motivation to maintain a good oral hygiene and attend regular dental care. This is in accordance with Lee GR, who also found a similar trend with DMFT and OHRQoL [32].

Once the elders become isolated from family their utilisation for dental service becomes sparse and moreover, the presence of depression hinders their interest towards improving oral hygiene and a negative self-perception of oral health [33].

The severity of depression was significantly associated with overall OHIP scores suggesting that severity of depression negatively affects the overall OHRQoL. In a Korean community dwelling elderly people, it was observed that oral health impact profile was significantly associated with depression [34]. Similarly, Polat U et al., investigated the relationship among health related quality of life and depression in elderly patients and observed that psychological, physiological and social factors affects the overall quality of life in elders [35].

When the seven dimensions of OHIP were compared to geriatric depression, all were highly associated with depression levels. Subjects with depression had a higher self-preserved functional limitation. This could be due to that most subjects were above 70 years and were removable denture wearers. Similarly, Andrade F et al., found subjects with depression having poor Geriatric Oral Health Assessment index (GOHAI) scores as represented by denture status and number of teeth, resulting in functional limitation [20]. Locker D and Slade G, and Steele JG et al., observed that tooth loss does significantly affect OHIP in older adults [36,37] and more remaining teeth indicated a less-negative impact on quality of life [38]. Likewise, Hassel AJ et al., observed that subjects from 61-98 years and wearing removable dentures had a negative OHIP score and reported a highest impairment of functional limitation [39].

The mean OHIP score in the present study for physical disability was perceived to be higher in subjects with depression which was statistically significant (p<0.001). This could be attributed to the fact that depression might lead to a decline in physical skills required to maintain functional independence and accelerate functional impairment in elderly individuals. This finding is similar to study by Wada T et al., across three Asian countries who observed that there is a significant inverse co-relation between geriatric depression and activities of daily living [40]. The subjects with severe depression had higher physical pain scores which were statistically significant. Physical pain and depression are related as cause and effect; the neurotransmitters that influence both pain and mood are serotonin and norepinephrine [41].

Dementia and subsequent cognitive impairment lead to increased psychological disability as experienced with pain and oral diseases. This finding is similar to Lee KH et al., who observed cognitive function and OHRQoL in older adults and concluded that subjects with poorer cognitive status has significantly worse OHRQoL compared to subjects without cognitive impairment [34]. In the present study, depression was significantly associated with increased social disability and handicap (p<0.001). A study done by Park B et al., found that depression is strongly associated with decreased social skills and impairment of carrying out activities of daily living [42].

This study is novel since it is the first of its kind to assess the relationship between geriatric depression and all dimensions of the oral health impact profile in this population. Additionally, this study is unique since the socio-demographic data and willingness for dental treatment was also assessed.

## LIMITATION AND FUTURE RECOMMENDATIONS

Considering some study subjects being above 80 years could have experienced mild cognitive impairment that influences the results of the study. Larger population-based longitudinal studies on the association between GDS and OHIP-14 are required in future to extend our results.

## CONCLUSION

The results of the present study suggest there was a strong correlation between GDS and OHIP-14. Presence of depression negatively affects the overall oral health related quality of life. The socio-demographic factors, oral hygiene and dental treatment needs were also associated with severity of depression.

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## REFERENCES

- [1] World population ageing, WHO. 2009. Men ageing and health, WHO. 2001
- [2] Amin G, Shah S, Vankar GK. The prevalence and recognition of depression in primary care. Indian J Psychiatry. 1998;40:364-69.
- [3] The WHO World Mental Health Consortium (2004) Prevalence, severity, and unmet need for treatment of mental disorders in the World Health Organization, World Mental Health Surveys. JAMA. 2004;291:2581-90.
- [4] Sidik S, Zulkefli N, Shah S. Factors associated with depression among elderly patients in a primary health care clinic in Malaysia. Asia Pac Fam Med. 2003;2:148-52.
- [5] Fleiz C, Villatoro J, Mora ME, Moreno M, Gutiérrez ML, Oliva N. Socio-demographic and personal factors related to depressive symptomatology in the Mexican population aged 12 to 65. Rev Bras Psiquiatr. 2012;34(4):395-404.
- [6] Chou KL, Cheung KC. Major depressive disorder in vulnerable groups of older adults, their course and treatment, and psychiatric co-morbidity. Depress Anxiety. 2013;30(6):528-37.
- [7] Wada T, Ishine M, Sakagami T, Okumiya K, Fujisawa M, Murakami S, et al. Depression in Japanese community-dwelling elderly-prevalence and association with ADL and QOL. Arch Gerontol Geriatr. 2004;39(1):15-23.
- [8] Subramaniam P, Pardeepa R, Ganeshan A, Mohan VP. Prevalence of depression in a large urban south indian population- the Chennai urban rural epidemiology study. Plos One. 2009;4(9):01-06.

- [9] Pracheth R, Mayur SS, Chowti JV. Geriatric depression scale: A tool to assess depression in elderly. *Int J Med Sci Public Health*. 2013;2:31-35.
- [10] Biswas S, Gupta R, Vanjare H, Bose S, Patel J, Selvarajan S, et al. Depression in the elderly in Vellore, South India: the use of a two-question screen. *International Psychogeriatrics*. 2009;21(2):369-71.
- [11] Reddy N, Pallavi M, Reddy N, Reddy C, Singh R, Pirabu R. Psychological morbidity status among the rural geriatric population of Tamil Nadu, India: A cross-sectional study. *Indian J Psychol Med*. 2012;34(3):227-31.
- [12] Sarkar S, Kattimani S, Roy G, Premarajan K, Sarkar S. Validation of the Tamil version of short form Geriatric Depression Scale-15. *J Neurosci Rural Pract*. 2015;6(3):442-46.
- [13] Sinha S, Shrivastava S, Ramasamy J. Depression in an older adult rural population in India. *MEDICC Review* 2013;15(4):41-44.
- [14] Radhakrishnan S, Nayeem A. Prevalence of depression among geriatric population in a rural area in Tamil Nadu. *International Journal of Nutrition, Pharmacology, Neurological Diseases*. 2013; 3(3):309-12.
- [15] Yesavage JA, Brink TL, Rose TL, Lum O, Huang V, Adey M, et al. Development and validation of a geriatric depression screening scale: A preliminary report. *J Psych Res*. 1982;17(1):37-49.
- [16] Sheikh JL, Yesavage JA. Geriatric depression scale (GDS): recent evidence and development of a shorter version. In: Brink TL, editor. *Clinical gerontology: a guide to assessment and intervention*. New York: Hawthorn Press; 1986. 517 p.
- [17] Slade GD, Spencer AJ. Development and evaluation of the Oral Health Impact Profile. *Community Dent Health*. 1994;11:3-11.
- [18] Slade GD. Derivation and validation of a short-form oral health impact profile. *Community Dent Oral Epidemiol*. 1997;25:284-90.
- [19] Locker D, Matear D, Stephens M, Lawrence H, Payne B. Comparison of the GOHAI and OHIP-14 as measures of the oral health-related quality of life of the elderly. *Community Dent Oral Epidemiol*. 2001;29:373-81.
- [20] Andrade F, Lebra M, Ferreira Santos J, Teixeira D, Duarte Y. Relationship between oral health-related quality of life, Oral health, socioeconomic, and general health factors in elderly Brazilians. *J Am Geriatr Soc*. 2012;60 (9):1755-60.
- [21] Esmeriz C, Meneghim M, Ambrosano G. Self-perception of oral health in non-institutionalised elderly of Piracicaba city, Brazil. *Gerodontology*. 2012;29:281-89.
- [22] Chang CF, Lin MH, Wang J, Fan JY, Chou LN, Chen MY. The relationship between geriatric depression health promoting behaviours among community dwelling seniors. *J Nurs Res*. 2013;21(2):75-82.
- [23] Lin QL, Kim HK, Ann JS. Relationship between depression and quality of life in elderly women living alone: The moderating and mediating effect of social support and social activity. *J Korean Gerontol Soc*. 2011;31(1):33-47.
- [24] Yamamoto T, Aida J, Kondo K, Fuchida S, Tani Y, Saito M, et al. Oral health and incident depressive symptoms: JAGES project longitudinal study in older Japanese. *J Am Geriatr Soc*. 2017;65(5):1079-84.
- [25] Dable RA, Nazirkar SG, Singh SB, Wasnik PB. Assessment of oral health related quality of life among completely edentulous patients in western India by using GOHAI. *J Clin Diagn Res*. 2013;7(9):2063-67.
- [26] Raja BK, Radha G, Rekha R, Pallavi SK. Relationship between the sense of coherence and quality of life among institutionalized elders in Bengaluru city India: A questionnaire study. *J Indian Assoc Public Health Dent*. 2015;13(4):479-85.
- [27] Ingle NA, Chaly PE, Zohara CK. Oral health related quality of life in adult population attending the outpatient department of a hospital in Chennai, India. *J Int Oral Health*. 2010;2(4):45-56.
- [28] Locker D, Allen FP. What do measures of 'oral health-related quality of life' measure?. *Community Dent Oral Epidemiol*. 2007;35:401-11.
- [29] Locker D, Gibson B. The concept of positive health: a review and commentary on its application in oral health research. *Community Dent Oral Epidemiol*. 2006;34:161-73.
- [30] Arslantas D, Ünsal A, Ozbabalik D. Prevalence of depression and associated risk factors among the elderly in Middle Anatolia, Turkey. *Geriatr Gerontol Int*. 2014;14:100-08.
- [31] Sanjay TV, Yannick PP, Madhusuda M, Masthi NRR, Gangaboraiah B. Depression and its associated factors among elderly patients attending rural primary health care setting. *Int J Community Med Public Health*. 2017;4(2):471-76.
- [32] Lee GR. The impact of DMFT index on oral health related quality of life in community-dwelling elderly. *J Korean Acad Dent Health*. 2008;32(3):396-404.
- [33] Mesas AE, de Andrade SM, Cabrera MA. Factors associated with negative self-perception of oral health among elderly people in a Brazilian community. *Gerodontology*. 2008;25:49-56.
- [34] Lee KH, Wu B, Plassman BL. Cognitive function and oral health-related quality of life in older adults. *J Am Geriatr Soc*. 2013;61(9):1602-07.
- [35] Polat U, Kaharaman BB, Kaynak I, Gorgulu U. Relationship among health-related quality of life, depression and awareness of home care services in elderly patients. *Geriatr Gerontol Int*. 2016;16(11):1211-19.
- [36] Locker D, Slade G. Association between clinical and subjective indicators of oral health status in an older adult population. *Gerodontology*. 1994;11(2):108-14.
- [37] Steele JG, Sanders AE, Slade GD, Allen PF, Lahti S, Nuttall N. How do age and tooth loss affect oral health impacts and quality of life? A study comparing two national samples. *Community Dent Oral Epidemiol*. 2004;32(2):107-14.
- [38] Joaquim AM, Wyatt CC, Aleksejūnienė J, Greggi SL, Pegoraro LF, Kiyak HA. A comparison of the dental health of Brazilian and Canadian independently living elderly. *Gerodontology*. 2010;27:258-65.
- [39] Hassel AJ, Koke U, Drechsel A, Kunz C, Rammelsberg P. Oral health-related quality of life in elderly. *Z Gerontol Geriatr*. 2005;38(5):342-46.
- [40] Wada T, Ishine M, Sakagami T, Okumiya K, Et al. Depression, activities of daily living and quality of life of community-dwelling elderly in the three Asian countries: Indonesia, Vietnam and Japan. *Arch Gerontol Geriatr*. 2005;41:271-80.
- [41] Trivedi MH. The link between depression and physical symptoms. *Prim Care Companion*. *J Clin Psychiatry*. 2004;6(1):12-16.
- [42] Park B, Jun JK, Park J. Cognitive impairment and depression in the early 60s: which is more problematic in terms of instrumental activities of daily living? *Geriatr Gerontol Int*. 2014;14:62-70.

#### PARTICULARS OF CONTRIBUTORS:

1. Reader, Department of Periodontics, SRM Dental College and Hospital, Chennai, Tamil Nadu, India.
2. Professor, Department of Periodontics, SRM Dental College and Hospital, Chennai, Tamil Nadu, India.
3. Professor and Head, Department of Periodontics, SRM Dental College and Hospital, Chennai, Tamil Nadu, India.

#### NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:

Dr. Deepa Ponnaiyan,  
F4, Rajendra Apartments, No. 9, Babu Rajendra Prasad Street, West Mambalam,  
Chennai, Tamil Nadu, India.  
E-mail: deepa\_ponnaiyan@yahoo.co.in

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