ORIGINAL ARTICLE

Association of state and trait anxiety with oral health status among adult dental patients

Nagarani Veeraboina[1], Dolar Doshi[2], Suhas Kulkarni[1], Patanapu Shiva Kumar[3], Dantala Satya Narayana[1], Adepu Srilatha[1]

[1] Department of Public Health Dentistry, Panineeya Institute of Dental Sciences and Hospital Hyderabad, India; [2] Department of Public Health Dentistry, Government Dental College and Hospital, Hyderabad, India; [3] Department of Public Health Dentistry, Kamineni Institute of Dental Sciences and Hospital, Narketpally, Nalgonda Dist, India

Summary. *Background:* Dental caries and periodontal diseases are the most prevalent oral health problems worldwide. Behavioral and psychosocial factors along with social, economic and cultural conditions may alter the health balance, favoring the onset of dental diseases. Hence the study was conducted to assess the association of state and trait anxiety with oral health status among adult dental patients. *Methods:* The study was carried out among 456 adult dental patients visiting Panineeya Institute of Dental Sciences and Hospital, Hyderabad. Anxiety levels were measured by State-Trait Anxiety Inventory-short version (STAI-S) consisting subscales State Anxiety (SA) and Trait Anxiety (TA). Clinical examination was done using WHO Basic Oral Health survey assessment form, 2013. The data was analyzed using Statistical Package for Social Sciences Software 21.0. p≤0.05 was considered statistically significant. *Results:* A significant gender difference (p=0.001) was noted for total anxiety with higher mean score observed among males (46.13±5.98) than females (45.32±6.00).Similarly, significant higher mean score was observed among males (23.31±4.08) than females (p=0.03) for State anxiety. Females had higher mean DMFT (3.61±3.21), DT (2.04±2.05), FT (0.49±1.34) and MT (1.08±2.09) components but significant difference was noted only for overall DMFT (p=0.03) and DT (p=0.001) component than males. *Conclusion:* Gender, education and previous dental visits didn't show any significant association with total anxiety, state and trait anxiety. Likewise, none of the oral parameters showed any significant association except for the Decayed Teeth (DT) component of DMFT with total anxiety levels among study subjects. (www.actabiomedica.it)

Key words: dental caries, dentition status, state anxiety, trait anxiety

Introduction

Dental caries and periodontal diseases are the most prevalent oral health problems worldwide (1). Even though, bacteria had been regarded as the prime etiological agent of periodontal disease and dental caries, bacteria itself is not capable of producing advanced tissue destruction in all individuals. This emphasizes the role of behavioral and psychosocial factors along with social, economic and cultural conditions that may alter the health balance, favoring the onset of dental

diseases (2). Evidence support the association of psychosocial factors like stress and anxiety with increase prevalence of dental caries and periodontal disease (1, 3-5).

In response to these psychological factors, sympathetic system may get stimulated and cause reduction in salivary flow leading to increased risk of caries in an individual (6). Furthermore, behavioural factors and stress may alter health balance, which can predispose the onset of periodontal diseases (7). Hence, all these factors acting together create favorable conditions for

the development of the disease in the individual (7). Moreover, individuals with high anxiety often neglect oral hygiene and tend to adopt harmful habits like changing eating habits, smoking etc, thus increasing the risk for dental diseases (6). Moreover, people with psychosocial problems have poor adherence to dental treatment and do not attend dentist regularly (8).

Anxiety can be either a short term 'state' or a long term 'trait'. State anxiety is a transitory emotional condition that varies in intensity and fluctuates over time and is used to determine an individual's present level of anxiety. Whereas trait anxiety is personality trait which remains relatively stable over time and is prone to describe a long -term anxiety level (9).

The relationship between anxiety and dental disease has been recognized since 1950s and has received renewed attention in recent years (1). A systematic review by Peruzzo et al (10) showed a positive relationship between periodontal diseases and psychological factors like stress, anxiety, depression. Moreover, Vettore et al (5) reported that patients with elevated levels of anxiety have a higher frequency of moderate pocket depth and clinical attachment level.

The relation between state and trait anxiety with oral health status has been researched in different types of studies (11-13) but the results have been inconclusive. Therefore, factors related to the social environment which provoke changes in host defense and indirectly cause tissue destruction should be taken into account. Based on this, the present study investigated the association of state and trait anxiety with oral health status among adult dental patients.

Materials and methods

A cross sectional study was carried out among adult dental patients visiting Panineeya Institute of Dental Sciences and Hospital, Hyderabad, Telangana. Ethical clearance was obtained from the Institutional Review Board of Panineeya Mahavidyalaya Institute of Dental Sciences and Research Centre (PMVIDS&RC/IEC/PHD/DN/0120-16). A pilot study was conducted among 30 patients to check feasibility of the study and to estimate the sample size. Subjects participating in the pilot study were excluded

from the final study sample. The subjects who gave written informed consent were included in the study. Subjects with any systemic conditions (like diabetics, pregnancy) affecting the periodontal status, requiring antimicrobial prophylaxis before clinical examination, history of medication (antibiotics and immunosuppressant) in the last one month and Subjects who have undergone oral prophylaxis in last three months were excluded.

The survey was conducted within the working hours of the hospital for a period of three months from the month of January 2018 to March 2018. The clinical examination of all the subjects was done by a single pre-trained, pre-calibrated examiner to limit intra-examiner variability. Plane mouth mirrors, Community Periodontal Index (CPI) probe was used to clinical examination. The survey tool comprised of Demographic details- age, gender, education and history of previous dental visit, short version-State-Trait Anxiety Inventory (STAI-S) questionnaire.

Assessment of State and Trait Anxiety levels

A self-reported twenty item State-Trait Anxiety Inventory-short version (STAI-S) by Bergua et al (22) was used to measure the state and trait anxiety levels in an individual. This inventory consists of two subscales; State Anxiety (SA) and Trait Anxiety (TA) comprising of ten items each. State anxiety scale measures how an individual feel at a particular time or condition, whereas Trait anxiety measures how a person generally feels regardless of the situation or condition the person is in. While, each item has four response options scored 1 (not at all) to 4 (very much so) and the total score on each subscale was the sum of the all item scores. Therefore, the possible total score ranging from a minimum of 10 to a maximum of 40 in both scales, with high score indicating high levels of state and trait anxiety.

Clinical oral examination

Dentition status was recorded based on the codes and criteria according to World Health Organization (WHO) Basic Oral Health survey assessment form, 2013 (21). While, periodontal condition was assessed using Community Periodontal Index (CPI) modified

and Loss of Attachment (LOA) according to World Health Organization (WHO) criteria 2013 (21).

Statistical tests

Statistical analyses were done using Statistical Package for Social Sciences Software (SPSS version 21.0). Chi-square analysis was used to find the significant difference of two or more variables. Mann- Whitney U test, Analysis of Variance (ANOVA) was used for comparison of mean scores of all variables based on gender. Karl Pearson's correlation was used to correlate State and Trait anxiety with Dentition Status, periodontal status and loss of attachment. Multiple linear regression analysis determined the association and compared the mean scores based on variables. Statistical significance was set at p≤0.05.

Results

A sample of 456 adult dental patients comprising of 232 (50.9%) males and 224 (49.1%) females participated in the study with mean age of 39.3±3.06 years. Around 41.2% attained secondary education, 37.3% had university education and only 21.5% of the population had primary education. Most of the study subjects visited dentist previously (308; 67.5%) compared to people who never visited a dentist (148; 32.5%). Based on gender, higher number of males visited a dentist (68.5%) compared to females (66.1%).

Based on responses to State Anxiety Inventory, majority of the subjects responded 'moderately so' (3) to all the questions except for the questions Q_1 (I am tense; 54.4%), Q_3 (I feel upset; 40.3%), Q_9 (I am worried; 40.6%) and Q_{10} (I feel confused; 58.5%), where in higher percentage of subjects responded for the option 'Not at all' (1).

Regarding Trait Anxiety Inventory, a similar pattern of responses were noticed apart from questions 'I feel like failure' (Q_{11}) (61.6%), 'I feel that difficulties are piling up so that I cannot overcome them'(Q_{12}) (59.4%), 'I get in a state of tension or turmoil as I think over my recent concerns and interests'(Q_{20}) (70.4%), where in higher percentage of subjects responded for the option 'Not at all' (1). Likewise, higher number of subjects

responded for option 'Somewhat' (2) for the question 'I worry too much over something that really doesn't matter' (Q_{13}) (35.3%), 'I have disturbing thought' (Q_{15}) (37.1%)and 'I lack self-confidence' (Q_{16}) (36.8%).

The question wise mean scores of the study subjects ranged from 2.99±0.89 to 1.45±0.80. When question wise mean STAI scores was compared according to gender, males showed significant higher mean scores for the questions Q_4(I feel satisfied) (p=0.02), Q_5 (I feel comfortable) (p=0.01), Q_7 (I am relaxed) (p=0.002),Q_{12} (I feel that difficulties are piling up so that I cannot overcome them) (p=0.04), Q_{13} (I worry too much over something that really doesn't matter) (0.001), Q_{14}(I am happy) (p=0.003) and Q_{19} (I am steady person) (p=0.05) than females. In contrast, females showed significant higher mean score for the questions Q_1 (I am tense) (1.75±0.87, p=0.04) and Q_2 (I feel at ease) (2.55±1.00, p=0.03) (Table 1).

Regarding total anxiety mean score, a significant gender difference (p=0.001) was noted with higher mean score observed among males (46.13±5.98) than females (45.32±6.00). Likewise, significant higher mean score for State Anxiety was also observed among males (23.31±4.08) than females (22.96±4.22) (p=0.03). However, Trait anxiety mean scores were comparable between males and females (p=0.14) (Table 2).

The overall caries experience among the study subjects was 83.1% and only 16.9% were caries free. Moreover, majority of the study population had gingival bleeding while probing (94.1%). With regard to periodontal status, around 62.1% had healthy periodontuim and 37.9% had periodontal pocket (pocket depth >4 mm). Based on Loss of Attachment (LOA), 26.3% of subjects had LOA of 4-5 mm (code-2) and only 2.8% had LOA of 6-8 mm (code 3).

Based on gender, higher percentage of females had caries (85.3%) and gingival bleeding (94.2%), but it was not statistically significant as compared to males (81.1% and 93.9%). Similarly, periodontal status was comparable between males and females (p=0.70). On the other hand, a significant gender difference was observed for LOA levels, where in higher number of females (30.8%) reported with LOA >4 mm (code 1 and code 2) as compared to their male counter parts (27.6%) (p=0.04) (Table 3).

Table 1. Question wise mean score comparison of State and Trait Anxiety Inventory (STAI) based on gender

Questions		Mean ± SD			
		Gender			
		Males	Females	p-value	Total
State Anxiety	Q_1	1.61±0.82	1.75±0.87	**0.04***	1.68±0.85
	Q_2	2.46±1.03	2.55±1.00	**0.03***	2.50±1.01
	Q_3	2.02±1.01	2.02±0.94	0.87	2.02±0.97
	Q_4	2.84±0.90	2.63±0.93	**0.02***	2.73±0.92
	Q_5	2.85±0.90	2.64±0.90	**0.01***	2.75±0.91
	Q_6	2.31±1.00	2.25±0.96	0.58	2.28±0.98
	Q_7	2.87±0.88	2.75±0.89	**0.002***	2.81±0.89
	Q_8	2.79±0.98	2.72±1.00	0.50	2.75±0.99
	Q_9	1.97±1.00	2.01±0.98	0.61	1.99±0.99
	Q_{10}	1.59±0.83	1.63±0.84	0.61	1.61±0.83
Trait Anxiety	Q_{11}	1.56±0.78	1.48±0.73	0.37	1.52±0.75
	Q_{12}	1.65±0.83	1.49±0.75	**0.04***	1.57±0.80
	Q_{13}	2.10±0.92	1.97±0.86	**0.001***	2.04±0.89
	Q_{14}	2.79±0.94	2.75±0.87	**0.003***	2.77±0.90
	Q_{15}	2.19±0.92	2.18±0.85	0.91	2.18±0.88
	Q_{16}	2.23±0.94	2.22±0.91	0.91	2.22±0.93
	Q_{17}	2.86±0.84	2.88±0.88	0.73	2.87±0.86
	Q_{18}	2.97±0.83	2.99±0.85	0.82	2.98±0.84
	Q_{19}	3.02±0.89	2.97±0.90	**0.05***	2.99±0.89
	Q_{20}	1.47±0.80	1.44±0.80	0.71	1.45±0.80

*p≤0.05 is statistically significant

Table 2. Comparison of overall mean scores of Total, State and Trait Anxiety based on gender

Variable	Mean ±S.D		
	Gender		
	Males	Females	p-value
State anxiety	23.31±4.08	22.96±4.22	**0.03***
Trait anxiety	22.82±3.28	22.36±3.44	0.14
Total anxiety	46.13±5.98	45.32±6.00	**0.001***

* p≤0.05 is statistically significant

Though, females had higher mean Decayed, Missing, Filled Teeth (DMFT-3.61±3.21), Decayed Teeth (DT-2.04±2.05), Missing Teeth (MT-1.08±2.09) and Filled Teeth (FT-0.49±1.34) scores, significant difference was noted only for overall DMFT (p=0.03) and DT (p=0.001) component.

The mean scores for gingival bleeding and pocket depth of >4 mm were comparable between males and females (p=0.69, p=0.44, respectively). However, significant higher mean LOA of >4 mm was noted among females (0.57±1.04) than males (0.45±0.94) (p=0.02) (Table 4).

Among male subjects, State Anxiety showed negative correlation with all the oral parameters except for overall DMFT (r=0.001) and Missing teeth component (r=0.02). On the other hand, Trait Anxiety showed positive correlation with all oral parameters except for Filled Teeth component (r= -0.07) and Loss of attachment >4 mm (r= -0.01). Furthermore, total anxiety showed negative correlation with Filled Teeth component (r= -0.06), pocket depth>4mm (r= -0.05) and LOA>4mm (r= -0.02). Nonetheless, none of the correlation was significant with the exception of overall DMFT for Trait Anxiety (p=0.03).

Among females, Filled Teeth component was the

Table 3. Distribution of study subjects based on prevalence of dental caries, periodontal status and LOA according to gender

Gender		n (%)			
		Males	Female	p-value	Total
Dental caries					
No caries		44 (18.9)	33 (14.7)	0.22	77 (16.9)
With caries		188 (81.1)	191 (85.3)		379 (83.1)
Bleeding status					
Bleeding absent		14 (6.1)	13 (5.8)	0.91	27 (5.9)
Bleeding present		218 (93.9)	211 (94.2)		429 (94.1)
Periodontal status					
Healthy periodontium		142 (61.2)	141 (62.9)	0.70	283 (62.1)
Periodontal disease		90 (38.8)	83 (37.1)		173 (37.9)
LOA					
Code 0	0-3 mm	168 (72.4)	155 (69.2)	**0.004***	323 (70.8)
Code 1	4-5 mm	54 (23.3)	66 (29.5)		120 (26.3)
Code 2	6-8 mm	10 (4.3)	3 (1.3)		13 (2.8)
Total		232 (50.9)	224 (49.1)		456 (100)

*p≤0.05 statistically significant

Table 4. Total mean score comparison of Oral parameters based on gender

Variable	Mean ±S.D		
	Gender		
	Males	**Females**	**p-value**
DT	1.94±2.27	2.04±2.05	**0.03***
MT	1.01±2.08	1.08±2.09	0.74
FT	0.48±1.19	0.49±1.34	0.91
DMFT	3.44±3.40	3.61±3.21	**0.001***
Gingival bleeding	11.78±5.48	12.00±5.92	0.69
Pocket depth >4 mm	0.73±0.93	0.66±0.95	0.44
LOA >4 mm	0.45±0.94	0.57±1.04	**0.02***

*p≤0.05 statistically significant

only oral parameter that showed negative correlation with State (r= -0.07), Trait (r= -0.02) and total anxiety (r= -0.06). Furthermore, a negative correlation was also observed for gingival bleeding and LOA>4 mm with State Anxiety (r= -0.03; r= -0.06, respectively) and Total Anxiety (r= -0.01; r= -0.04, respectively). Nevertheless, the above correlations were not statistically significant.

When the entire study subjects were considered, Overall DMFT and its components were positively correlated with Total Anxiety, State Anxiety (SA) and Trait Anxiety (TA) except for the Filled Teeth component (r= -0.06; SA; r= -0.05; TA; r= -0.04, respectively). Likewise, pocket depth>4mm also showed negative correlation with State (r= -0.03), Trait (r= -0.02) and Total Anxiety levels (r= -0.00). Further, a negative correlation was also observed for gingival bleeding with state (r=-0.03) and total anxiety (-0.00) and for LOA with only State anxiety (-0.02). However, no statistical significance observed for the correlation.

None of the demographic variables and oral parameters showed any significant correlation with the STAI scale. Pocket depth >4 mm had negative correlation with both subscales and total anxiety scores. On the contrary, education showed positive impact with all anxiety levels. Gender, history of dental visits and presence of gingival bleeding revealed negative correlation with only state and total anxiety, whereas LOA had negative correlation with only state anxiety levels (Table 5).

Discussion

Occasional anxiety is a normal part of life; but anxiety that's persistent, seemingly uncontrollable and overwhelming can be disabling (23). Higher anxiety levels among individuals interferes with daily activities leading to generalized anxiety disorder, panic disorder, agoraphobia or social anxiety disorder (24). In addition, anxiety also affects social activities and it may also lead to problems in family relations (25). On the other hand, anxiety and/or fear related physiological, mental and behavioural alterations may have significant effects on both oral and general health (26). Thus, it might be one of the reasons for worsening the oral health status and may also influence utilization of the health care services. Anxiety is the one of the major barrier for avoiding health services in the entire medical field (27). Hence, dentists' must try to understand and obtain information about patients' anxiety levels, as it influences the treatment outcomes (28). Therefore, the present study evaluated the association between State and Trait Anxiety with oral health status among adult dental patients.

Apart from State and Trait Anxiety Inventory (STAI), Hamilton Anxiety Rating Scale (HAM-A) (29), Beck Anxiety Inventory (BAI) (30), Generalized Anxiety Disorder -7 (GAD -7) (31) and Hospital Anxiety and Depression Scale- Anxiety (32) (HADS-A) can be used to measure the anxiety levels. Among them, STAI is more economical in terms of all dimensions and is the most widely researched and popularly used measures of general anxiety till date (33). This measure is relatively brief to administer and less time consuming scoring or interpretation procedures (33). Thus, in the present study short form of STAI scale was used to measure anxiety.

Likewise, dentition status, periodontal status and loss of attachment was quantified based on codes and criteria of World Health Organization proforma 2013, as it is simple to use and reliable and allows for international comparisons (21).

The World Health Organization (WHO) distinguishes 35-44 years as the standard age group for surveillance of oral health conditions in adults. Further, the full effect of dental caries, the levels of severe periodontal involvement, and the general effects of oral

Table 5. Correlation between Total anxiety, State and Trait anxiety with oral parameters based on gender

Gender	Variables	State anxiety		Trait anxiety		Total anxiety	
		r-value	p-value	r-value	p-value	r-value	p-value
Males	DMFT	0.001	0.97	0.05	**0.03***	0.03	0.62
	DT	-0.004	0.94	0.05	0.36	0.02	0.65
	MT	0.02	0.66	0.07	0.28	0.05	0.37
	FT	-0.03	0.58	-0.07	0.24	-0.06	0.31
	Gingival bleeding	-0.03	0.56	0.06	0.34	0.00	0.90
	Pocket depth >4 mm	-0.07	0.23	0.005	0.93	-0.05	0.44
	LOA >4 mm	-0.02	0.66	-0.01	0.77	-0.02	0.65
Females	DMFT	0.02	0.67	0.02	0.75	0.03	0.64
	DT	0.02	0.66	0.03	0.59	0.04	0.53
	MT	0.06	0.34	0.01	0.86	0.05	0.45
	FT	-0.07	0.25	-0.02	0.73	-0.06	0.31
	Gingival bleeding	-0.03	0.63	0.005	0.93	-0.01	0.76
	Pocket depth >4 mm	0.03	0.63	0.01	0.79	0.03	0.62
	LOA >4 mm	-0.06	0.24	0.006	0.94	-0.04	0.44
Total	DMFT	0.01	0.77	0.03	0.43	0.03	0.52
	DT	0.01	0.82	0.04	0.31	0.03	0.47
	MT	0.04	0.33	0.03	0.40	0.05	0.25
	FT	-0.05	0.22	-0.04	0.30	-0.06	0.15
	Gingival bleeding	-0.03	0.44	0.03	0.50	-0.00	0.87
	Pocket depth >4 mm	-0.03	0.49	-0.00	0.94	-0.02	0.60
	LOA >4 mm	-0.02	0.56	0.03	0.46	0.00	0.99

health care can be measured. In light of the above, the WHO index age group of 35-44 years has been chosen in the current study (21).

Previous studies conducted among Brazilian adults (34) and studies (35-37) among Turkish adult dental patients showed that females had higher mean scores for total anxiety. The, present study showed that, males had significantly higher mean scores for total anxiety (46.13±5.98). This could be attributed to the education levels in the present study. i.e., 62.5% of males were non-graduates. As suggested by Andrews et al (38), higher educational levels like graduates have

a greater feeling of well-being and are less anxious to confronting challenging life events.

In the present study, females had higher percentage for caries (83.1%), bleeding on probing (94.1%) and loss of attachment >4 mm (30.8%). One reason for this could be due to the changes in salivary flow rates and composition induced by hormonal fluctuation like increasing adrenaline and/or decreased levels of thyroid and estrogen hormones (39). However, the unobserved variables such as socioeconomic status, brushing methods and frequency etc. might have attributed to the above findings on oral parameters (40).

In current study, females had significantly higher mean scores for overall caries experience (3.61±3.21) and decayed teeth (2.04±2.05). In converse, a study by Delgado-Angulo et al (8) among Finnish adults aged 30 years and above showed that males had higher mean decayed teeth (1.07±2.28). According to Shaffer et al (41), the factors that cause women to experience a greater burden of dental caries are early tooth eruption (therefore increased time of exposure to cariogenic processes), differences in dietary behaviors, access and utilization of oral health care etc.

Females also had significantly higher mean scores for loss of attachment >4 mm (0.57±1.04). Similar findings were observed by Solis et al (11) among Brazilian adults with higher mean score among females (0.95±0.5) than males. This was in consonance with Hess et al (42), who suggested that hormonal changes during puberty, menstruation, pregnancy and menopause can cause an exaggerated response to irritants from bacterial plaque. This sensitizes gingiva and further increases risk of having periodontal disease. The condition worsens if patients are already prone to periodontal diseases.

A previous study by Akarslan et al (9) among Turkish adults attending the Gazi University of Dental School showed that no significant correlation of DMFT with trait anxiety based on gender. Nevertheless, in the current study, DMFT among males had significant positive correlation with trait anxiety. As for Indian scenario most men are the head of the family with imposed burden of responsibilities and financial problems on them leading to long term increased anxiety levels and there by neglected oral health problems.

However, this study acknowledges certain limitations such as cross-sectional study design, small sample size and use of self-assessment questionnaire, making it difficult to draw any conclusion about causal relationship. Further representative research is needed to determine the impact of psychological factors as risk factors for caries and periodontal disease.

Conclusion

The study concluded that, a significant gender difference was noted with higher mean score among

males for state anxiety and total anxiety. However, higher number of females reported with LOA >4 mm as compared to their male counter parts. Moreover, significantly higher mean score was noted among females for overall DMFT, DT and LOA of >4 mm. Gender, education and previous dental visits didn't show any significant association with total anxiety, state and trait anxiety. However, none of the oral parameters showed any significant association except for the Decayed Teeth (DT) component of DMFT with total anxiety levels among study subjects

Hence, particular attention through preventive programs for oral health and periodontal care should be implemented and targeted for individuals with higher overall anxiety levels. Although a positive relationship was observed between anxiety and periodontal disease, further representative research is needed to determine the impact of anxiety/psychological factors as risk factors for periodontal disease.

Acknowledgment

References

1. Alkan A, Cakmak O, Yilmaz S, Cebi T, Gurgan C. Relationship Between Psychological Factors and Oral Health Status and Behaviors. Oral Health Prev Dent 2015; 13(4): 331-9.
2. Castro GD, Oppermann RV, Haas AN, Winter R, Alchieri JC. Association between psychosocial factors and periodontitis: a case-control study. J Clin Periodontol 2006; 33(2): 109-14.
3. Vettor M, Quintanilha RS, Monterio da Silva AM, Lamarca GA, Leao ATT. The influence of stress and anxiety on the response of non- surgical periodontal treatment. J Clin Periodontol 2005; 32: 1226-35.
4. Kesim SI, Unalan D, Esen C, Ozturk A The relationship between periodontal disease severity and state-trait anxiety levels. J Pak Med Assoc 2012; 62(12): 1304-8.
5. Vettore MV, Leao AT, Monteiro Da Silva AM, Quintanilha

RS, Lamarca GA. The relationship of stress and anxiety with chronic periodontitis. J Clin Periodontol 2003; 30(5): 394-402.

6. LeResche L, Dworkin SF. The role of stress in inflammatory disease, including periodontal disease: review of concepts and current findings. Periodontol 2000 2002; 30: 91-103.

7. Goyal S, Gupta G, Thomas B, Bhat KM, Bhat GS. Stress and periodontal disease: The link and logic!! Ind Psychiatry J 2013; 22(1): 4-11.

8. Delgado-Angulo EK, Sabbah W, Suominen AL, et al. The association of depression and anxiety with dental caries and periodontal disease among Finnish adults. Community Dent Oral Epidemiol 2015; 43(6): 540-9.

9. Akarslan ZZ, Erten H, Uzun O, Iseri E, Topuz O. Relationship between trait anxiety, dental anxiety and DMFT indexes of Turkis patients attending a dental school clinic. East Mediterr Health J 2010; 16(5): 558-62.

10. Peruzzo DC, Benatti BB, Ambrosano GM, et al. A systematic review of stress and psychological factors as possible risk factors for periodontal disease. J Periodontol 2007; 78: 1491-504.

11. Solis AC, Lotufo RF, Pannuti CM, Brunheiro EC, Marques AH, Lotufo-Neto F. Association of periodontal disease to anxiety and depression symptoms, and psychosocial stress factors. J Clin Periodontol 2004; 31: 633-8.

12. Jamieson LM, Paradies YC, Gunthorpe W, Cairney SJ, Sayers SM. Oral health and social and emotional well-being in a birth cohort of aboriginal Australian young adults. BMC Public Health 2011; 11: 656.

13. Genco RJ, Ho AW, Grossi SG, Dunford RG, Tedesco LA. Relationship of stress, distress and inadequate coping behaviors to periodontal disease. J Periodontal 1999; 70: 711-23.

14. Monteiro da Silva AM, Newman HN, Oakley DA, O'Leary R. Psychosocial factors, dental plaque levels and smoking in periodontitis patients. J Clin Periodontol 1998; 25(6): 517-23.

15. Kheir OO, Abu-bakr NH, Ibrahim YE. Investigation of the relationship between dental anxiety ant trait anxiety among a sample of Sudanese patients. Indian J Stomatol 2013;4(3):71-75.

16. Akhigbe KO, Koleoso ON. Trait anxiety, sex, age and dental treatment experience as determinants of dental anxiety among chronic dental patients in Nigeria. Eur Sci J 2014; 10(12): 316-28.

17. Hofer D, Thoma MV, Schmidlin PR, Attin T, Ehlert U, Nater UM. Pre-treatment anxiety in a dental hygiene recall population: a cross-sectional pilot study. BMC Oral Health 2016; 16: 43.

18. Doganer YC, Aydogan U, Yesil HU, Rohrer JE, Williams MD, Agerter DC. Does the trait anxiety affect the dental fear? Braz Oral Res 2017; 31: 36.

19. Le SH, Tonami K, Umemori S, Nguyen LT, Ngo LT, Mataki S. The potential of heart rate variability for exploring dental anxiety in mandibular third molar surgery. Int J Oral Maxillofac Surg 2018; 47(6): 809-15.

20. Ahmadi M, Kiakojori A, Moudi S. Association of Anxiety with Pain Perception following Periodontal Flap Surgery. J Int Soc Prev Community Dent 2018; 8(1): 28-33.

21. World Health Organization. Oral health surveys: basic methods. 5th ed; Geneva Publishers; 2013.

22. Bergua V, Meillon C, Potvin O, et al. The STAI-Y trait scale: psychometric properties and normative data from a large population-based study of elderly people. Int Psychogeriatr 2012; 24(7): 1163-71.

23. Young EA, Abelson JL, Cameron OG. Effect of comorbid anxiety disorders on the hypothalamic –pituitary – adrenal axis response to a social stressor in major deression. Biol Psychiatry 2004; 56(2): 113-20.

24. Bandelow B, Michaelis S, Wedekind D. Treatment of anxiety disorders. Dialogues Clin Neurosci 2017; 19(2): 93-107.

25. Robinson E, Rodgers B, Butterworth P. Family relationships and mental illness: Impacts and services responses. Australian Family Relationship Clearing House 2014; 4(1): 1-15.

26. Pumar MI, Gray CR, Walsh JR, Yang IA, Rolls TA, Ward DL. Anxiety and Depression-Important psychological co morbidities of COPD. J Thorac Dis 2014; 6(11): 1615-31.

27. Knaak S, Mantler E, Szeto A. Mental illness-related stigma in healthcare: Barriers to access and care and evidence-based solutions. Health Manage Forum 2017; 30(2): 111-6.

28. Appukuttan DP Strategies to manage patients with dental anxiety and dental phobia: literature review. Clin Cosmet Investig Dent 2016; 8: 35-50.

29. Hamilton M. the assessment of anxiety states by rating. Br J Med Psychol 1959; 32(1): 50-5.

30. Muntingh AD, van der Feltz-Cornelis CM, van Marwijk HW, Spinhoven P, Penninx BW, van Balkom AJ. Is the Beck Anxiety Inventory a good tool to assess the severity of anxiety? A primary care study in the Netherlands Study of Depression and Anxiety (NESDA). BMC Fam Pract 2011; 12(1): 66.

31. Dugas MJ, Gagnon F, Ladouceur R, Freeston MH. Generalized anxiety disorder: A preliminary test of a conceptual model. Behav Res Therap 1998; 36(2): 215-26.

32. Bjelland I, Dahl AA, Haug TT, Neckelmann D. The validity of the Hospital Anxiety and Depression Scale: an updated literature review. J Psychosomatic Res 2002; 52(2): 69-77.

33. Julian LJ.Measures of anxiety: State-Trait Anxiety Inventory (STAI), Beck Anxiety Inventory (BAI), and Hospital Anxiety and Depression Scale-Anxiety (HADS-A). Arthritis Care Res (Hoboken) 2011; 63(11S): 467-72.

34. Fuentes D, Gorenstein C, Hu LW. Dental anxiety and trait anxiety: an investigation of their relationship. British Dent J 2009; 206(8): 17-14

35. Bergua V, Meillon C, Potvin O, et al. Short STAI-Y anxiety scales: validation and normative data for elderly subjects. Aging Ment Health 2016; 20(9): 987-95.

36. Potvin O, Bergua V, Meillon C, et al. Norms and associated factors of the STAI-Y State anxiety inventory in older adults: results from the PAQUID study. Int Psychogeriatr 2011; 23(6): 869-79.

37. Talo Yildirim T, Dundar S, Bozoglan A, et al. Is there a relation between dental anxiety, fear and general psychological status? Peer J 2017; 5: 2978.

38. Andrews B, Wilding JM. The relation of depression and anxiety to life stress and achievement in students. Br J Psychol 2004; 95(4): 509-21.

39. Jezova D, Hlavacova N. Endocrine factors in stress and psychiatric disorders: focus on anxiety and salivary steroids. Ann N Y Acad Sci 2008; 1148: 495-503.

40. Heasman PA, Holliday R, Bryant A, Preshaw PM. Evidence for the occurrence of gingival recession and non-carious cervical lesions as a consequence of traumatic toothbrushing. J Clin Periodontol 2015; 42 (16): S237-55.

41. Shaffer JR, Leslie EJ, Feingold E, et al. Caries Experience Differs between Females and Males across Age Groups in Northern Appalachia. Int J Dent 2015; 2015: 938213.

42. Hess RF, Gilill CS, Demba J. Prevalence and Predictors of Periodontal Disease among Pregnant Women in Mali, West Africa. Ann Med Health Sci Res 2017; 7(4).

Dr.Patanapu Shiva Kumar
Department of Public Health Dentistry
Kamineni Institute of Dental Sciences and Hospital
Sreepuram, Narketpally, Nalgonda(Dist).
Telangana, India
E-mail: shivakumarkittu@gmail.com