Association between Physical Activity, Anxiety, and Periodontitis: A Cross-sectional Study from Andhra Pradesh, India

ANILKUMAR KANAKAMEDALA[1], GAUTAMI S PENMETSA[2], VL AISHWARAYA[3], RAMA LAXMI KORUPROLU[4], ARUN BHUPATHI[5], NVS SRUTHIMA GOTTUMUKKALA[6]

ABSTRACT

Introduction: Periodontitis is a prevalent inflammatory disease affecting the supporting structures of teeth, often exacerbated by psychosocial factors such as anxiety. Concurrently, Physical Activity (PA) has been identified as a protective factor for mental health. The interplay between PA, anxiety, and periodontal disease has gained attention in recent years, particularly in understanding their implications for overall health.

Aim: To investigate the association between PA levels, anxiety and periodontitis.

Materials and Methods: The present cross-sectional study was conducted involving 240 participants from Andhra Pradesh, India. Participants underwent a thorough periodontal examination, including measurements of clinical attachment loss. PA levels were assessed using the International PA Questionnaire, while anxiety levels were evaluated using the Generalised Anxiety Disorder (GAD)-7 scale. Statistical analysis was performed to explore the associations among PA, anxiety, and periodontal parameters.

Results: The total number of participants was 240, of which males were 110 (45.8%) and females were 130 (54.2%) with the mean age of 45±5.7 years. Results showed that out of 240 participants, 61 (25.4%) had no periodontitis, while 105 (43.8%) had mild, 68 (28.3%) moderate and 6 (2.5%) severe periodontitis. Anxiety levels among the participants, 169 (70.4%) reported no anxiety, 55 (22.9%), mild, 14 (5.8%) moderate, and 2 (0.8%) severe anxiety. PA levels were low in 103 (42.9%) of participants, moderate in 84 (35%), and high in 53 (22.1%). Significant differences were found between periodontitis and both Generalised Anxiety Disorder (GAD) scores and PA levels, with a weak positive correlation observed between periodontitis and GAD scores (p=0.029) as well as between periodontitis and PA (p<0.001). This analysis revealed that participants with lower levels of PA exhibited a significantly higher risk for periodontitis (p<0.001) and elevated anxiety scores. Furthermore, a positive correlation was found between higher anxiety levels and reduced PA, suggesting a compounded risk for periodontal health deterioration.

Conclusion: The present study demonstrates a clear association between reduced PA, increased anxiety, and the prevalence of periodontal disease. The results highlight the worth of encouraging physical exercise as a possible tactic to reduce anxiety and enhance periodontal health. Further research is warranted to explore the underlying mechanisms of these relationships and to develop targeted interventions that can enhance PA and overall well-being.

INTRODUCTION

Periodontal diseases are prevalent both in developed and developing countries and affect about 20-50% of global population. Periodontitis is a common chronic inflammatory Non-communicable Disease (NCD) and the sixth most common ailment globally [1]. Additionally, periodontitis is one of the unfavourable effects of pregnancy and is linked to a number of systemic illnesses, such as diabetes and Cardiovascular Disease (CVD) [2,3]. A number of variables, including being overweight, smoking, experiencing anxiety, having an unhealthy diet, having genetic polymorphisms, and physical inactivity, are linked to the development of disease and act as risk factors for various other prevalent NCDs such Type-2 Diabetes Mellitus (T2DM) and CVD [4,5].

PA is a controllable risk factor for the onset and progression of inflammatory and metabolic diseases. Emerging evidence suggests that PA may help prevent and manage periodontal disease by reducing systemic inflammation and shared risk factors, though further research is needed to establish causation and clarify mechanisms [6]. Also, a case control study by Cataldo D et al., found that older age, anxiety, and poorer oral health-related quality of life are significantly associated with periodontitis [7]. Sanders AE et al., found that while PA was not directly associated with periodontitis, it was linked to lower inflammatory markers (IL-1β and CRP), especially among individuals with periodontitis [8].

Similarly, some research has also shown that the effects of PA reduce the prevalence of periodontitis [9-11]. According to a comprehensive review, PA lowered the prevalence of periodontitis in observational studies [12]. GAD is one of the most common anxiety conditions contributing to significant burden and disability, and it serves as a diagnostic foundation for other anxiety disorders due to its representation of core emotional disorder traits [13]. Results from general population surveys covering almost 1,50,000 adults across 26 nations showed that the combined lifetime prevalence of diagnostic and statistical manual of mental disorders score 5 (DSM-5) GAD was 3.7% [14]. Anxiety is currently the most widespread emotional condition which triggers psychological stress. With 3.7% prevalence, it affects a significant segment of the global population in a variety of social, professional, familial, and individual combinations, reflecting the stresses of modern life and the complexities of contemporary societies [15].

Researchers have recently examined whether psychosocial factors contribute to periodontitis [16]. Chronic and aggressive periodontitis, as well as the advancement of periodontal disease, are linked to various psychological disorders [13,17]. It is essential to identify modifiable lifestyle habits for effectively preventing and

managing periodontal diseases. Healthcare providers involved in periodontal disease treatment and management have a crucial role in encouraging healthy patient behaviours and addressing the challenge of behaviour change intervention [18]. The present study holds significant relevance because it addressed the complex interplay between PA, anxiety, and periodontitis - three factors that individually and collectively impact general and oral health. While existing literature has separately explored the effects of anxiety and physical inactivity on periodontal health, comprehensive investigations that assess their combined influence remain limited [19]. Therefore, the present study aimed to explore the association between PA, anxiety, and periodontitis.

MATERIALS AND METHODS

The present single centre cross-sectional study was conducted at Vishnu Dental College, Bhimavaram, Andhra Pradesh in India between January 2024 to July 2024. All consecutive patients attending the Department of Periodontology at the Vishnu Dental College were included in the study. The study was carried out in compliance with strengthening the reporting of observational studies in epidemiology (STROBE) guidelines. The ethical approval was taken from Vishnu Dental College, Bhimavaram, Andhra Pradesh with number IECVDC/24/F/PI/IVV/91.

Inclusion and exclusion criteria: Individuals from 18 to 70 years from both male and female genders were included. The exclusion criteria were participants with any chronic systemic complications and pregnancy or lactation, patients who underwent periodontal therapy in last 12 months, and history of antibiotics within the last six months.

Before participation, informed consent was obtained from all the participants. Convenience sampling technique was used and a total of 240 study participants were included in the study and the response rate was 100%.

Study Procedure

Two skilled examiners underwent standardised training and calibration sessions prior to data collection, including theoretical instruction and practical exercises to ensure consistent measurement of Clinical Attachment Levels (CAL). Examiners were calibrated by performing a full periodontal chart on two non-study subjects affected by periodontitis. A 95% agreement threshold was established to guarantee high reliability; as precise CAL measurement is critical for accurate periodontal diagnosis. Examiner reproducibility was defined as having at least 95% agreement in CAL (with a maximum 2 mm difference) between two repeated measurements [20]. The Kappa score achieved was 0.94, indicating almost perfect agreement between examiners and confirming the consistency and validity of the periodontal assessments.

Periodontal Probing Pocket Depth (PPD), plaque, and bleeding on probing, gingival recession were recorded with a standardised periodontal probe at six sites per tooth, third molars excluded. Whenever the Cemento Enamel Junction (CEJ) was sub-gingival, CAL was measured as the difference between PPD and the distance between the free gingival margin and the CEJ. The presence of furcation involvement was recorded according to the classification of Hamp [21] the classification of Miller [22] was used for recording tooth mobility. In the current study, only those who had a thorough periodontal examination were taken into consideration. Using the American Academy of Periodontology (AAP)/Centre for Disease Control and Prevention (CDC) criteria, periodontitis was diagnosed and classified as mild, moderate, or severe [23].

After the periodontal examination, the questionnaire was given to the participants regarding PA and anxiety. The questionnaire consists of sociodemographic characteristics including age and gender. Although both age and gender were considered during case selection due to their relevance in periodontal disease prevalence,

only gender was included in the statistical analysis and reported in the results. Participants were questioned whether they had ever received a diagnosis and confirmation from the doctor that they had one of the illnesses listed above. Self-reported chronic illnesses were verified through interviews and medical record reviews when available. Standardised questions helped minimise bias, and clear criteria were used to exclude participants with uncontrolled systemic diseases, ensuring reliable and consistent health data.

During data collection, they were also questioned about their normal pharmaceutical regimen. The categories of smoking status were non-smokers, former smoker, and current smoker. A professional interviewer conducted a structured interview with participants to complete the questionnaire.

Evaluation of PA: The validated and reliable short-form International PA Questionnaire (IPAQ-SF) was used for collecting self-reported PA data, ensuring consistency with international research standards [24]. It includes seven questions on how often and for how long the patients have engaged in intensive and moderate PA, walking, or sedentary activities throughout the last seven days. The IPAQ report graded the total PA level as low, moderate, or high.

Evaluation of anxiety: To ascertain the existence and severity of GAD, a self-administered seven-item test known as GAD-7 was utilised as a screening tool [25,26]. The items enumerate the essential diagnostic elements of the initial DSM-IV diagnostic criteria for GAD. Participants during the examination are asked how often, in the preceding two weeks, they had encountered signs of anxiety, such as trepidation, difficulty falling asleep, etc. On a 4-point Likert scale, the response options for each item range from 0 to 3 (0=not at all, 1=several days, 2=more than half the days, and 3=almost every day). The sum of the scores for each of the seven elements yields the GAD-7 total score, which ranges from 0 to 21. In the present study, the interpretation proposed by Robert L. Spitzer, who originally developed the GAD-7, categorising scores into minimal (0-4) mild (5-9), moderate (10-14), and severe (15-21) anxiety levels was followed [25].

STATISTICAL ANALYSIS

The data was collected through the patient questionnaire forms and the collected data is digitalised into Microsoft Excel. Then the data is fed to IBM Statistical Package for Social Sciences (SPSS) software for statistical analysis (Version 26.0, IBM, Chicago). Descriptive analysis was performed and presented as Mean±SD. A Chi-square test determined the association between periodontitis and other variables. The correlation was done by using Pearson's correlation coefficient test for categorical variables. $p \leq 0.05$ was considered statistically significant.

RESULTS

The total number of participants was 240, of which males were 110 (45.8%) and females were 130 (54.2%). Mean age of the participants was 45±5.7 years. Out of 240 participants, 53 (22.1%) had the habit of smoking and 67 (27.9%) had the habit of drinking alcohol. Out of the total of 240 participants 178 (74.2%) brushed once daily and 62 (25.8%) brushed twice Daily, 61 (25.4%) had no periodontitis, 105 (43.8%) had mild periodontitis, 68 (28.3%) had moderate periodontitis and 6 (2.5%) had severe periodontitis. The distribution of the participants according to the anxiety score was that 169 (70.4%) had no anxiety, 55 (22.9%) had mild, 14 (5.8%) moderate and 2 (0.8%) had severe anxiety. 103 (42.9%) of the study participants had the low PA, 84 (35%) had moderate PA and 53 (22.1%) had high PA [Table/Fig-1].

Categories		Frequency (N)	Percentage (%)
Gender	Male	110	45.8
	Female	130	54.2

Smoking	Yes	53	22.1
	No	187	77.9
Drinking	Yes	67	27.9
	No	173	72.1
Dental floss	Yes	75	31.3
	No	165	68.8
Frequency of brushing	Once	178	74.2
	Twice	62	25.8
Periodontitis	No periodontitis	61	25.4
	Mild periodontitis	105	43.8
	Moderate periodontitis	68	28.3
	Severe periodontitis	6	2.5
GAD Score	Minimal anxiety	169	70.4
	Mild anxiety	55	22.9
	Moderate anxiety	14	5.8
	Severe anxiety	2	0.8
MET Score	Low Physical Activity (PA)	103	42.9
	Moderate PA	84	35.0
	High PA	53	22.1

[Table/Fig-1]: Shows the descriptive distribution of the participants.

There was a highly significant association between periodontitis and the PA (p<0.001) [Table/Fig-2]. Similarly, highly statistically significant association was observed between the periodontitis and the GAD scores (p=0.001) [Table/Fig-3]. There was a weak positive correlation between periodontitis and GAD scores (r=0.141, p=0.029) and PA scores. (r=0.269, p=0.001) [Table/Fig-4].

Association between periodontitis and Physical Activity (PA)		MET Score			Total	Chi-square value	p-value
		Low	Moderate	High			
Periodontitis	Absent	41 (17.1%)	12 (5.0%)	8 (3.3%)	61 (25.4%)	30.270	<0.001**
	Mild	38 (15.8%)	49 (20.4%)	18 (7.5%)	105 (43.8%)		
	Moderate	22 (9.2%)	21 (8.8%)	25 (10.4%)	68 (28.3%)		
	Severe	2 (0.8%)	2 (0.8%)	2 (0.8%)	6 (2.5%)		
	Total	103 (42.9%)	84 (35.0)	53 (22.1)	240 (100%)		

[Table/Fig-2]: Shows the association between periodontitis and Physical Activity (PA).
Chi-square test done-*p≤0.05 statistically significant** p=0.00 highly statistically significant

Association between periodontitis and anxiety		GAD Score				Total	Chi-square value	p-value
		Minimal	Mild	Moderate	Severe			
Periodontitis	Absent	45 (18.8%)	12 (.0%)	4 (1.7%)	0 (0.0%)	61 (25.4%)	82.4	0.001**
	Mild	78 (32.5%)	21 (8.8%)	6 (2.5%)	0 (0.0%)	105 (43.8%)		
	Moderate	44 (18.3%)	20 (8.3%)	4 (1.7%)	0 (0.0%)	68 (28.3%)		
	Severe	2 (0.8%)	2 (0.8%)	0 (0.0%)	2 (0.8%)	6 (2.5%)		
	Total	169 (70.4%)	55 (22.9%)	14 (5.8%)	2 (0.8%)	240 (100%)		

[Table/Fig-3]: Association between periodontitis and anxiety.
Chi-square test done *p≤0.05 statistically significant **p=0.00 highly statistically significant

Correlation between periodontitis and the risk factors		Periodontitis	GAD Score	MET score
Periodontitis	Pearson Correlation (r)	1	0.141*	0.269**
	p-value	-	0.029	0.001
GAD Score	Pearson Correlation (r)	0.141*	1	0.191**
	p-value	0.029		0.003
MET total score	Pearson Correlation (r)	0.269**	0.191**	1
	p-value	0.001	0.003	

[Table/Fig-4]: Correlation between periodontitis, GAD scores and Physical Activity (PA) scores.
Pearson correlation test done: *p≤0.05 statistically significant **p<0.000 highly statistically significant

DISCUSSION

The present study aimed to examine the relationship between PA levels, anxiety, and periodontitis in a South Indian population. This study included a total of 240 participants, with 110 males and 130 females. The results demonstrate a significant association between PA and periodontitis with general anxiety. By reducing the circulatory pro-inflammatory mediators linked with alveolar bone loss and degradation of the connective tissue loss, PA aids in reducing the incidence of periodontitis [6]. The identification of the risk indicators of psychosocial and behavioural factors indicates periodontitis progression. Very few studies are available in the literature stating the association between the periodontitis and PA [6-9,11].

Cross sectional studies conducted by Sakki TK et al., and Shizukuishi S et al., which were carried out in Finland and Japan, respectively, found no association between periodontitis and PA [27,28]. However, a systematic review by Ferreira RD et al., concluded that PA was associated with reduction of periodontal disease prevalence [12]. The study by Merchant AT et al., also showed periodontitis individuals had significant association with PA, where participants with increased PA lead to about 13% reduction in men for the initiation and progression of periodontal disease [11]. The results of the present study indicated that reduced PA is associated with an increased risk of periodontal disease, whereas higher levels of PA are linked to a reduced risk. There was a highly statistically significant association between periodontitis and the PA.

The present study found a significant association between anxiety and periodontitis. A statistically significant association was observed between anxiety and periodontitis, showing a weak positive correlation (p=0.001). These findings are consistent with those reported in previous studies [29-31]. However, Castro GD et al., and Solis AC et al., in their study used State-Trait Anxiety Inventory (STAI) for assessing the anxiety levels, showed no association between periodontitis and anxiety [32,33]. The levels of anxiety in individuals where greater in subjects with periodontal disease when compared with healthy periodontium. Therefore, it is understood that factors such as anxiety, stress, and psychosocial conditions play a detrimental role in the progression of periodontal disease [34]. A similar study conducted by Iwasaki M et al., involving approximately 310 Japanese workers examined the relationship between total PA and periodontitis. After adjusting for potential confounders, the study found an inverse association between total PA and both the presence and severity of periodontitis in women. The multivariable-adjusted odds ratios for periodontitis across the second to fifth

quintiles of total PA (compared to the lowest quintile) were 0.81 (95% CI: 0.59-1.12), 0.74 (0.53-1.02), 0.77 (0.55-1.06), and 0.64 (0.46-0.89), respectively, with a significant trend (p=0.01). Similar results were observed when examining domain- and intensity-specific PA [35].

The interplay between anxiety, PA, and periodontitis can be complex: PA can help reduce anxiety, leading to better oral hygiene and reduced risk of periodontitis. Thus, regular exercise might be a protective factor against periodontitis due to its stress-reducing effects. The direct benefits of PA on periodontal health include improved circulation, which can aid in maintaining healthy gums. Understanding an individual's anxiety levels can help tailor interventions for periodontitis. For example, individuals with high anxiety might benefit from stress management programs alongside standard periodontal treatments. These life-style changes are shown to lower the risk of other confounding risk factors like diabetes mellitus against the periodontium [2], by acting as a preventive factor for maintaining over-all oral health. Literature has also shown that, increased PA showed reduction in the diabetic levels by lowering the glycated haemoglobin's levels and blood sugar levels by enhancing the insulin activity [36]. Anxiety can significantly affect dental health, influencing periodontitis onset and progression. Individuals with high levels of anxiety might neglect oral hygiene or have difficulty maintaining a consistent oral care routine. Poor oral hygiene increases the risk of developing periodontitis. Anxiety might contribute to bruxism (teeth grinding), which can lead to increased wear and tear on the gums and contribute to periodontal issues.

Limitation(s)

The limitations of the present study include the cross-sectional design, which did not allow for a clear determination of the causal relationships among periodontitis, PA, and anxiety. Further research is necessary to gain a comprehensive understanding of the underlying factors contributing to these associations, particularly the inflammatory elements involved in disease progression. Future longitudinal studies are needed to support the direct role of PA in periodontitis and to identify preventive measures. Additionally, this survey was limited to a South Indian population, the findings may not be generalised. Finally, the reliance on self-reported health status and PA could introduce bias into the results.

CONCLUSION(S)

In conclusion, this research indicates that there is a significant correlation between PA levels, anxiety, and periodontitis. The findings indicate that individuals with reduced PA are at a higher risk for both increased anxiety and periodontal issues. This emphasises how crucial it is to encourage regular exercise as a possible strategy to reduce anxiety and enhance oral health. Future studies should explore the mechanisms underlying these associations and develop targeted strategies to enhance PA among the patients suffering from periodontitis.

REFERENCES

[1] Eke PI, Thornton-Evans GO, Wei L, Borgnakke WS, Dye BA, Genco RJ. Periodontitis in US adults. J Am Dent Assoc. 2018;149(7):576-88.

[2] Sanz M, Ceriello A, Buysschaert M, Chapple I, Demmer RT, Graziani F, et al. Scientific evidence on the links between periodontal diseases and diabetes: Consensus report and guidelines of the joint workshop on periodontal diseases and diabetes by the International Diabetes Federation and the European Federation of Periodontology. Diabetes Research and Clinical Practice. 2018;137:231-41.

[3] Sanz M, Kornman K, Working Group 3 of the Joint EFP/AAP Workshop. Periodontitis and adverse pregnancy outcomes: Consensus report of the Joint EFP/AAP Workshop on Periodontitis and Systemic Diseases. Journal of Periodontology. 2013;84:S164-S169.

[4] Aggarwal K, Gupta J, Kaur RK, Bansal D, Jain A. Effect of anxiety and psychologic stress on periodontal health: A systematic review and meta-analysis. Quintessence Int. 2022;53(2):144-54.

[5] Reynolds MA. Modifiable risk factors in periodontitis: At the intersection of aging and disease. Periodontology 2000. 2014;64(1):07-19.

[6] Chan CC, Chan AK, Chu CH, Tsang YC. Physical activity as a modifiable risk factor for periodontal disease. Frontiers in Oral Health. 2023;4:1266462.

[7] Cataldo D, Mourão LC, Gonçalves LS, Canabarro A. Association of anxiety, age and oral health-related quality of life with periodontis: A case-control study. International Journal of Dental Hygiene. 2024;22(3):540-44.

[8] Sanders AE, Slade GD, Fitzsimmons TR, Bartold PM. Physical activity, inflammatory biomarkers in gingival crevicular fluid and periodontitis. Journal of Clinical Periodontology. 2009;36(5):388-95.

[9] Al-Zahrani MS, Borawski EA, Bissada NF. Increased physical activity reduces prevalence of periodontitis. J Dent. 2005;33(9):703-10.

[10] Al-Zahrani MS, Borawski EA, Bissada NF. Periodontitis and three health-enhancing behaviors: Maintaining normal weight, engaging in recommended level of exercise, and consuming a high-quality diet. J Periodontol. 2005;76(8):1362-66.

[11] Merchant AT, Pitiphat W, Rimm EB, Joshipura K. Increased physical activity decreases periodontitis risk in men. European Journal of Epidemiology. 2003;18:891-98. Doi: https://doi.org/10.1023/A:1025622815579.

[12] Ferreira RO, Corrêa MG, Magno MB, Almeida APCPSC, Fagundes NCF, Rosing CK, et al. Physical activity reduces the prevalence of periodontal disease: Systematic review and meta-analysis. Front Physiol. 2019;10:234.

[13] Gonçalves DC, Pachana NA, Byrne GJ. Prevalence and correlates of generalized anxiety disorder among older adults in the Australian National Survey of Mental Health and Well-Being. J Affect Disord. 2011;132(1-2):223-30.

[14] Dhira TA, Rahman MA, Sarker AR, Mehareen J. Validity and reliability of the Generalized Anxiety Disorder-7 (GAD-7) among university students of Bangladesh. Innamorati M, editor. PLOS ONE. 2021;16(12):e0261590.

[15] Ruscio AM, Hallion LS, Lim CC, Aguilar-Gaxiola S, Al-Hamzawi A, Alonso J, et al. Cross-sectional comparison of the epidemiology of DSM-5 generalized anxiety disorder across the globe. JAMA Psychiatry. 2017;74(5):465-75.

[16] Nivetha S. Association between psychosocial factors and periodontitis: A case–control study (Master's thesis, Rajiv Gandhi University of Health Sciences (India)). Available from: https://www.proquest.com/openview/369f34037fa28b083d4c7f ecded85b06/1?pq-origsite=gscholar&cbl=2026366&diss=y.

[17] Monteiro Da Silva AM, Oakley DA, Newman HN, Nohl FS, Lloyd HM. Psychosocial factors and adult onset rapidly progressive periodontitis. J Clin Periodontol. 1996;23(8):789-94.

[18] Hwang SY, Jang JH, Park JE. Association between healthy lifestyle (diet quality, physical activity, normal body weight) and periodontal diseases in Korean Adults. Int J Environ Res Public Health. 2022;19(7):3871.

[19] Vettore MV, Leão ATT, 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.

[20] Heitz-Mayfield LJ. Conventional diagnostic criteria for periodontal diseases (plaque-induced gingivitis and periodontitis). Periodontology 2000. 2024;95(1):10-19.

[21] Hamp Hamp SE, Nyman S, Lindhe J. Periodontal treatment of multirooted teeth. Results after 5 years. J Clin Periodontol. 1975;2:126-35.

[22] Miller SC. Textbook of Periodontia: Oral medicine. (No Title). 1943.

[23] Page RC, Eke PI. Case definitions for use in population-based surveillance of periodontitis. Journal of Periodontology. 2007;78:1387-99.

[24] Macfarlane DJ, Lee CC, Ho EY, Chan KL, Chan DT. Reliability and validity of the Chinese version of IPAQ (short, last 7 days). Journal of Science and Medicine in Sport. 2007;10(1):45-51.

[25] Spitzer RL, Kroenke K, Williams JB, Löwe B. A brief measure for assessing generalized anxiety disorder: The GAD-7. Archives of Internal Medicine. 2006;166(10):1092-97.

[26] Kroenke K, Wu J, Yu Z, Bair MJ, Kean J, Stump T, et al. Patient health questionnaire anxiety and depression scale: Initial validation in three clinical trials. Psychosomatic Medicine. 2016;78(6):716-27.

[27] Sakki TK, Knuuttila ML, Vimpari SS, Hartikainen MS. Association of lifestyle with periodontal health. Community Dent Oral Epidemiol. 1995;(23):155-58.

[28] Shizukuishi S, Hayashi N, Tamagawa H, Hanioka T, Maruyama S, Takeshita T, Morimoto K. Lifestyle and periodontal health status of Japanese factory workers. Annals of Periodontology. 1998;3(1):303-11.

[29] Laforgia A, Corsalini M, Stefanachi G, Pettini F, Di Venere D. Assessment of psychopatologic traits in a group of patients with adult chronic periodontitis: Study on 108 cases and analysis of compliance during and after periodontal treatment. Int J Med Sci. 2015;12(10):832-39.

[30] Levin L, Zini A, Levine J, Weiss M, Lev R, Chebath Taub D, et al. Demographic profile, Oral Health Impact Profile and Dental Anxiety Scale in patients with chronic periodontitis: A case–control study. Int Dent J. 2018;68(4):269-78.

[31] Naghsh N, Mogharehabed A, Karami E, Yaghini J. Comparative evaluation of the cortisol level of unstimulated saliva in patients with and without chronic periodontitis. Dent Res J. 2019;16(6):421.

[32] Castro GD, Oppermann RV, Haas AN, Winter R, Alchieri JC. Association between psychosocial factors and periodontitis: A case–control study. Journal of Clinical Periodontology. 2006;33(2):109-14.

[33] 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. Journal of Clinical Periodontology. 2004;31(8):633-38.

[34] Makkar H, Reynolds MA, Wadhawan A, Dagdag A, Merchant AT, Postolache TT. Periodontal, metabolic, and cardiovascular disease: Exploring the role of inflammation and mental health. Pteridines. 2018;29(1):124-63.

[35] Iwasaki M, Yoshihara A, Suwama K, Zaitsu T, Suzuki S, Ihira H, et al. A cross-sectional study of the association between periodontitis and physical activity in the Japanese population. Journal of Periodontal Research. 2023;58(2):350-59.

[36] Yun I, Joo HJ, Park YS, Park EC. Association between physical exercise and glycated hemoglobin levels in Korean patients diagnosed with diabetes. Int J Environ Res Public Health. 2022;19(6):3280.

PARTICULARS OF CONTRIBUTORS:
1. Associate Professor, Department of Periodontics, Vishnu Dental College, Vishnupur, Bhimavaram, Kovvada, Andhra Pradesh, India.
2. Professor and Head, Department of Periodontics, Vishnu Dental College, Vishnupur, Bhimavaram, Kovvada, Andhra Pradesh, India.
3. Senior Lecturer, Department of Periodontics, Vishnu Dental College, Vishnupur, Bhimavaram, Kovvada, Andhra Pradesh, India.
4. Senior Lecturer, Department of Public Health Dentistry, Vishnu Dental College, Vishnupur, Bhimavaram, Kovvada, Andhra Pradesh, India.
5. Assistant Professor, Department of Orthodontics, Vishnu Dental College, Vishnupur, Bhimavaram, Kovvada, Andhra Pradesh, India.
6. Professor, Department of Periodontics, Vishnu Dental College, Vishnupur, Bhimavaram, Kovvada, Andhra Pradesh, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Anilkumar Kanakamedala,
Associate Professor, Department of Periodontics, Vishnu Dental College,
Vishnupur, Bhimavaram, Kovvada-534202, Andhra Pradesh, India.
E-mail: dranilkumar1979@gmail.com