

## Association of Mental Depression with Periodontal Disease

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### **Abstract:**

### **Introduction:**

Microbial dental plaque causing inflammation of tooth supporting structures is known as periodontal disease. It is influenced by smoking, poor oral hygiene, systemic diseases, psychological factors like depression, and other factors (Fatima et al., 2016). The purpose of this present research was to assess the link between mental depression with periodontal disease using clinical parameters and a depression rating scale.

### **Materials and Methods:**

A total of 172 subjects (matched for age and sex) were enrolled. For evaluation of periodontal disease, oral hygiene index(OHI), probing pocket depth (PPD), gingival index(GI), and clinical

attachment level (CAL) were recorded (Fatima et al., 2016). The “Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision criteria” were used to determine whether or not any of the subjects had depression, and the severity of depression was measured by PHQ-9 scale.

**Results:** Subjects with depression had significantly fair oral hygiene with healthy periodontium, mild calculus and bleeding on probing was observed in few patients.

**Conclusion:** This study came to the conclusion that mental depression has no effect on the periodontium and is not a risk factor for periodontal disease.

**Key words:** Depression, Probing Pocket Depth (PPD), Clinical Attachment Loss (CAL), Oral hygiene index (OHI), Gingival Index (GI)

## Introduction

Chronic periodontitis is an inflammatory disease of the periodontium, mediated by host-bacterial interaction and manifested by destruction of periodontal tissues, loss of connective tissue attachment and alveolar bone (Garlet, 2010). Although labelled as a multifactorial disease, literature shows that periodontal disease develops as a result of bacterial buildup and environmental variables, which in turn create a microbial challenge in the host and dysregulation of the host-microbe interaction is the primary initiating factor (Amano et al., 2004, Sun et al., 2020). It also depends on a number of other things, hygienic status of Oral Cavity, smoking, and certain systemic diseases like diabetes mellitus and cardiovascular disease. It also depends on psychological factors like depression and stress (Genco, 1996). Stress and depression have a major impact on a host's immunological response, and they also have a big impact on a large portion of the modern population. (Tylee et al., 2018)

An estimated 300 million individuals worldwide are thought to be affected by depression, the main mental health-related condition in the globe. Mental stress and depression are currently the fourth-leading causes of the worldwide illness burden, according to the World Health Organization (WHO), but by 2030 they are predicted to be the second-leading causes.(Kareem et al., 2021). Depression is characterized by persistent, prolonged periods of hopelessness, meaninglessness, and despondency (low spirit)(Lund et al., 2018). It has been demonstrated that it keeps people from realizing their full potential, degrades human capital, and is linked to early death from illnesses like suicide (Patel et al., 2016)

It is a known fact that depression has a significant effect on the immune system of the host. The current literature supports the link between infectious disease and depression, creating a possibility that there might be a link between periodontal disease and depression too (Warren et al., 2014). In the state of depression glucocorticoids can cause decrease in the secretion of pro-inflammatory cytokines (tumor necrosis factor, interleukins and prostaglandins) on the other hand, catecholamines (epinephrine and norepinephrine) make proteolytic enzymes and prostaglandins, which can cause tissue damage indirectly. Poor oral hygiene practices, dietary changes, altered sleep patterns, and smoking are also linked to depression, which can either directly or indirectly predispose a patient to periodontal health deterioration. (O'Neil et al., 2014)

Numerous studies have suggested the biological plausibility of a connection between depression and periodontitis. (Ng and Keung Leung, 2006, Sun et al., 2020). According to these studies, depression and stress may alter an individual's immune response, increasing the likelihood that the individual will develop a decaying condition and affecting their periodontal health(Park et al., 2014, Sun et al., 2020). There are few biological-psychological explanations explaining the connection between depression and periodontal health. The most significant of the suggested

pathways, which seek to link psychosocial issues to periodontitis through the neglect of oral health care behaviour. (Okoro et al., 2012, Aleksejuniené et al., 2002, Sun et al., 2020, Peixia Shi, 2021)

The systemic levels of C-reactive protein, interleukin-6, interleukin-1, and tumour necrosis factor-alpha are frequently greater in patients with periodontitis. A mix of elements connected to behavioural changes are likely the mechanisms behind the association between psychological stress, depression, and periodontitis (Warren et al., 2014)

According to reports, depression affects between 22% and 60% of Pakistan's population overall (Godil et al., 2017, Kareem et al., 2021). A study done by O Kareem et.al. has found a positive relationship between depression and dental caries and periodontal disease. Other than that, no study has been done in Pakistan and the international data cannot be implemented in our population. The potential reasons could be differences in socio-demographic, racial, and genetic factors (Kareem et al., 2021).

Because it is well recognised that psychological conditions can affect how chronic diseases progress, studies on the association between psychological factors and periodontitis must be properly planned. Periodontal disease prevention and treatment may be improved as a result of knowledge of this link. (A. C. O. Solis, 2004). The purpose of this study was to assess the relationship between periodontal clinical characteristics and symptoms of anxiety, sadness, or mental illness.

## **Material and methods:**

### **Study setting**

This study was conducted in the department of Periodontology at Ziauddin University in Karachi.

## **Study population**

An age- and sex-matched sample of 172 volunteers from both genders, recruited by a screening service, with ages ranging from 20 to 69 years, made up the study population..

## **Selection criteria**

According to Machtei et al. (1992), cases (patients with "established periodontitis") were those who had clinical attachment loss (CAL) of 6mm or more than that in two or more interproximal sites from various teeth or at least one additional site with a pocket depth (PD) of 5mm or higher. Those patients who didn't fit the bill were referred to as controls (periodontally "healthy"). The exclusion criteria included patients who had received periodontal therapy within the previous three months, those who disclosed any systemic condition that might have prevented a periodontal clinical examination, uncontrolled diabetes mellitus, Human immunodeficiency virus infection, haematological, allergic, and hormonal conditions, patients with CVD, smokers, and those who took calcium-channel blockers or immunosuppressants. The study excluded participants who were pregnant or nursing.

## **Periodontal assessment**

In order to assess the periodontium, a single examiner who had been calibrated prior to the study's start evaluated OHI (DI and CI; Greene and Vermillion, 1960), GI (GI; Loe and Silness, 1967), PPD, and clinical attachment level (CAL) using University of North Carolina15 (UNC15 probes Hufriedy, USA) probes. Using repeated measurements separated by seven days, the intra-examiner reliability was assessed. For PD and CAL, the intra-class correlation coefficients were 0.938 (p 0.001) and 0.811 (p 0.001).

### **Assessment of depression**

After clinical examination the patients were assessed for the presence of depression by “Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision criteria” and severity of depression was measured by Patient Health Questionnaire Depression Scale (PHQ-9)<sup>17</sup>. The PHQ-9 was graded on a scale of 0–3, where 0 meant not at all, 1 meant a few days, 2 meant more than a week, and 3 meant virtually every day. The PHQ-9 total score ranges from 0 to 27; scores between 5 and 9 are considered mild depression, 10 to 14 are considered moderate depression, 15 to 19 are considered moderately severe depression, and 20 and above are considered severe depression. (Sun et al., 2020)

**Statistical analysis:** Sample size calculation was done using open epi where confidence interval was set at 95% and power of test was set at 80%. SPSS version 20 (Statistical Package for Social Sciences) was used for results analysis. A mean and standard deviation were used to summarise the data. By using a one-way Anova of variance, groups were compared. Chi square test was done for categorical comparisons. Mann-Whitney U-test and Kruskal-Wallis test were used to compare several periodontal indices.  $P < 0.05$  is considered as significant.

### **Ethical Approval**

Ethical approval: Ethical approval was taken from the “Ethical review committee of Ziauddin University” (4491121SQOM)

## **RESULTS**

A total of 172 individuals were recruited, out of which 89 were males and rest were females. Depression patients' periodontal indicators were compared to those of mentally well people, and

the difference were calculated. Patients with depression had their periodontal indices and oral hygiene practises examined.

**Table 1 indicates oral hygiene index in patients with depression**

	Good	Fair	Poor	Total	P value
Mild depression	7	43	12	62	0.034*
Moderate depression	17	21	14	52	
Moderately severe depression	13	16	8	37	
Severe depression	3	11	7	21	
Total	40	91	41	172	

\*P < 0.05 is considered as significant.

Regarding oral hygiene index majority of patients with depression had fair oral hygiene.

**Table 2 indicate gingival index in patients with depression**

	Normal	Mild	Bleeding on probing	Spontaneous bleeding	Total	p-value
Mild depression	15	10	33	4	62	

Moderate depression	21	12	11	8	52	0.072
Mod. severe depression	9	5	11	12	37	
Severe depression	3	7	6	5	21	
Total	48	34	61	29	172	

$P < 0.05$  is considered as significant.

Table 2 indicates that a total of majority of the patients (61) with depression was facing bleeding on probing out of which 33 had mild depression ,11 of them had moderate and 11 of them moderately severe depression and 6 had severe depression. Whereas, 48 patients with depression has normal gingival index.

**Table 3 indicates periodontal pocket depth in patients with depression**

	0	1	2	3	Total	P value
Mild depression	6	25	27	4	62	0.000*
Moderate depression	25	13	3	11	52	
Moderately severe depression	16	9	8	4	37	

Severe depression	3	9	6	3	21
Total	50	56	44	22	172

$P < 0.05$  is considered as significant.

Regarding periodontal pocket depth total of 56 patients had 1 mm of periodontal pocket depth out of which 25 of them had mild depression with statistically significant results. These results were closely followed by the depressive patients having 0 mm of periodontal pocket depth.

**Table 4 indicates calculus in patients with depression**

	No calculus	Mild calculus	Mod.calculus	Sev.calculus	Total	P value
Mild depression	6	25	27	4	62	0.000*
Moderate depression	25	13	6	8	52	
Moderately severe depression	13	12	8	4	37	
Severe depression	3	9	8	1	21	

Total	47	59	49	17	172	
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$P < 0.05$  is considered as significant.

Regarding calculus in patients with depression, a total of 59 patients with depression has mild calculus out of which 25 had mild depression. This was closely followed by patients with moderate calculus (49) out of which 27 was suffering from mild depression. These results were statistically significant.

## **DISCUSSION**

In the present study periodontal status of depressive patients were evaluated. Periodontal status was monitored by evaluating oral hygiene index, periodontal pocket depth and clinical attachment loss. The findings of our present study does not show any significant association between depression and periodontal status. In the present study 89 males were recruited out of which majority of them had mild depression and among female's majority of them suffered with moderate depression. These results indicate that the "female preponderance in depression" could be relevant to the sex hormonal level (e.g., estrogen). Studies conducted over time show that when oestrogen levels increase (first menstruation of girls) (Johnson EO, (2006), Sun et al., 2020, Peixia Shi, 2021), the rate of serious depression also increases at the same time (Peixia Shi, 2021, Sun et al., 2020). According to numerous reports, cyclic oestrogen variations are consistently linked to the highest rate of depression during reproductive years, with females more likely to experience depression during premenstrual, pregnancy, postpartum, and perimenopausal stages (Direkvand-Moghadam A, 2014) (Peixia Shi, 2021, Sun et al., 2020).

Regarding oral hygiene index majority of patients had fair oral hygiene as mentioned in Table 1. Similar to our study, one more research also shown that oral hygiene practises and inflammatory

immune responses had no effect on depression. One of the study also reported that depression was independent of dental hygiene practises and an inflammatory immune reaction (Rodríguez Franco et al., 2020, Sun et al., 2020, Peixia Shi, 2021). Contrary to our study, one of the research indicated that patients who are depressed are more likely to experience dental caries, tooth loss, and poor periodontal and gingival health. (Mohammadi et al., 2019, Sun et al., 2020). Considering gingival index as mentioned in table 2, majority of patients with depression suffered from bleeding on probing when examined. Blood and salivary cortisol, lipopolysaccharides, and other markers of cellular and systemic stress that cause inflammation may be involved in the bleeding upon probing. (D'Ambrosio et al., 2022, Neupane et al., 2022).

Regarding periodontal pocket depth majority of the patients with mild depression has 2mm of pocket depth whereas patients with moderate depression has 0 mm of pocket depth which indicates there good oral hygiene as mentioned in table 3. Similar to our study Bakri et al also reported that there was no difference means of CAL and PD in stressed and non-stressed patients (Bakri et al., 2013). Regarding clinical attachment loss majority of the patients had mild to moderate calculus and shows positive association (0.000) between calculus in patients with depression. Few studies also predicted the clinical attachment level, but against the expectation a higher level of depressive symptomatology predicted less clinical attachment loss (Rodríguez Franco et al., 2020, Sun et al., 2020). It might be due to the reason that there is a lack of understanding of the entire mechanisms needed to confirm a link or an association between depression and periodontitis. Few limitations of the current research is that findings are based on observations and correlations rather than establishing a causal link or specifying the process by which such correlations are produced. It is important to remember that several methodological problems are to blame for discrepancies in the literature also. First off, there is no evidence of a cause-and-effect association between depression

and periodontitis because the information is solely based on case series and cross-sectional studies. A minimal number of subjects are typically used in investigations (20 to 100 participants and only a few studies exceed 120 participants). Additionally, there are differences in the definition of periodontitis and the inclusion criteria between studies. For example, some studies base their diagnosis solely on probing depths, others on partial rather than a full-mouth examination, and still others on radiographic evidence of bone loss, all of which have different cutoffs, leading to differences in the severity of periodontitis and its definition.

Similar to that, depression is assessed using a variety of techniques and is typically self-reported. Another major limitation of the analysis and comparison of the many research is the lack of a common definition of depression and the difficulty in discriminating between acute and chronic stress. Also not always evaluated are variables like coping behaviour, a crucial component of the individual's response. Last but not least, comorbidities including diabetes mellitus, cardiovascular disease, and rheumatoid arthritis are frequently linked to stress, although this problem is also underexamined in the literature. Additionally, not all of the co-factors are taken into account. As previously discussed, depression and stress affects the host's defence in a variety of ways by affecting immunological and neuroendocrine mechanisms as well as way of life. Similar to other complicated diseases, periodontitis has a variety of causes, including genetic variability, immunity, bacterial diversity, and environmental influences. Finally, stress-related behavioural changes such changes in food, oral hygiene practises, and dental appointments are not adequately taken into account.

Future research must bring together experts from several fields to comprehend the fundamental mechanisms underlying the preclinical impact of depression on periodontal disease. Prior to doing a clinical evaluation, it is important to identify the markers or conditions that best indicate the

impact of depression and how they relate to periodontal disease. More persons who acquire periodontitis should be included in prospective studies. To achieve similar outcomes, evaluation of co-factors and comorbidities should be taken into account, and established illness thresholds should be applied. Last but not least, a fascinating question that has not yet been examined is whether there is a bidirectional relationship between depression and periodontitis. Specifically, whether periodontitis functions as a trigger for stress as well.

**Conclusion:** This study came to the conclusion that mental depression has no effect on the periodontium and is not a risk factor for periodontal disease

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#### **Conflicts of interest**

There are no conflicts of interest.

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