Research Article

Exploring the Correlation Between Oral and Systemic Health Status Among COVID-19–Affected Patients: A Cross-Sectional Study in Bhopal City

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ABSTRACT:

Background: Coronavirus disease (COVID-19) has been linked with multisystem involvement and may influence oral health.Pain plays an important role in influencing anxiety and depression among patients, and understanding this relationship is important for comprehensive patient care to evaluate the correlation between oral and systemic health among COVID-affected patients.

Materials & Methods: A cross-sectional study was conducted among 200 post-COVID participants. Data on systemic and psychological variables were collected using a structured questionnaire. Pain was assessed using the Visual Analog Scale (VAS), while anxiety and depression were evaluated using validated measures. Oral health was assessed using DMFT index, OHI-S, Gingival Index, and periodontal status. Pearson correlation and multiple linear regression analyses were performed using SPSS version 30 ($p < 0.05$).

Results: DMFT showed a positive correlation with the Gingival Index, while OHI-S was positively correlated with anxiety and depression.Pain was found to be associated with anxiety and depression.The Gingival Index was associated with breathlessness on exertion. Regression analysis identified DMFT, OHI-S, periodontal status, and breathlessness as significant predictors of self-rated health ($p < 0.05$). The model explained 21.6% of the variance (Adjusted $R^2 = 0.189$, $p < 0.001$). **Conclusion:** Oral health was significantly associated with systemic health indicators in COVID-affected patients. These findings highlight the importance of integrating oral health into post-COVID care.

KEY WORDS: COVID-19, Oral Health, Systemic Health, Periodontal Disease, DMFT, OHI-S.

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INTRODUCTION:

In recent years, there has been a lot of interest in the idea of a reciprocal relationship between oral and systemic health. Numerous studies have shown links between poor oral health and systemic disorders such as cardiovascular diseases, diabetes mellitus, respiratory infections, and unfavorable pregnancy outcomes. The oral cavity serves as an important indicator of overall systematic health.[1] Since oral infections and inflammatory mediators spread into the bloodstream, periodontal disease in particular has been highlighted as a potential risk factor for systemic inflammation.[2]

Understanding underlying medical problems that may affect illness susceptibility, severity, and outcomes is crucial, as demonstrated by the appearance of Coronavirus illness 2019 (COVID-19), which is

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caused by the SARS-CoV-2 virus. Although COVID-19 primarily affects the respiratory system, it is now understood to be a multisystem illness with substantial immunological and inflammatory involvement. There is evidence that patients who already have systemic problems are more likely to experience catastrophic COVID-19 results.[3]

There may be a connection between COVID-19 severity and dental health, according to recent research.[4] The clinical course of COVID-19 may worsen due to increased systemic inflammation and bacterial superinfections brought on by poor oral hygiene and periodontal disease.[5] Furthermore, the oral cavity may be involved in viral entry and transmission due to the presence of angiotensin-converting enzyme 2 (ACE2) receptors in oral tissues, specifically in the tongue and salivary glands. Patients with COVID-19 have also been found to have changes in their oral health condition, such as xerostomia, taste changes, mucosal lesions, and opportunistic infections.[6,7]

There is still little data examining the direct connection between systemic health issues and oral health status in COVID-19 patients, despite increased interest. Developing integrated healthcare strategies that highlight the relevance of oral health in overall disease management and prevention requires an understanding of this link.

Thus, the current study uses a cross-sectional strategy to investigate the relationship between oral and systemic health status among COVID-19-affected patients. The results of this study emphasize the significance of integrating oral healthcare into complete patient treatment and may help to clarify the relationship between oral and systemic health in the context of COVID-19.

MATERIALS & METHODS:

Study Design and Setting-To investigate the relationship between oral and systemic health status among COVID-19-affected individuals, a cross-sectional observational study was conducted. The study was carried out in Bhopal, Madhya Pradesh, India, from January 2025 to June 2025 in the Department of Public Health Dentistry and associated medical and dental facilities.

Study Population and Sample Size- A total of 200 patients with a verified history of COVID-19 infection were included in the study. Based on predetermined inclusion and exclusion criteria, patients were chosen. In order to account for the anticipated link between oral and systemic health markers, the sample size was determined using the appropriate statistical procedure with a 95% confidence level and an 80% power.

Inclusion Criteria:

- Patients with a confirmed history of COVID-19 (RT-PCR/antigen test positive)
- Age ≥18 years
- Willing to participate and provide informed consent

Exclusion Criteria:

- Patients with severe systemic conditions unrelated to COVID-19 that could confound results
- Patients undergoing ongoing periodontal treatment
- Completely edentulous individuals
- Individuals unwilling to participate

Data Collection Procedure:

Data was gathered using a systematic proforma following ethical clearance and informed consent. The evaluation of systemic health status and oral health status made up the two parts of the study. Standard infection control procedures were used for the clinical oral examination, and the Oral Hygiene Index-Simplified (OHI-S), Plaque Index, Gingival Index and DMFT index were used to assess dental caries and oral health status. Pain was assessed using the Visual Analog Scale (VAS). Anxiety and depression were measured using the Hospital Anxiety and Depression Scale (HADS), a validated questionnaire consisting of 14 items with separate subscales for anxiety and depression. Medical records and patient histories provided systemic health data, including details on comorbid conditions such as diabetes, hypertension, and respiratory disorders. Hospitalization history and duration were also documented, along with information on COVID-19 severity (classified as mild, moderate, or severe based on clinical records).

Data was analyzed using SPSS version 30.0. Descriptive statistics were calculated. Pearson's correlation test was used to assess the relationship between oral and systemic health variables, and multiple linear regression analysis was performed to identify predictors of self-rated health status. A p-value <0.05 was considered statistically significant.

RESULTS:

Table 1 presents the demographic characteristics of the post-COVID participants (n = 200). The majority of participants were in the 31–45 years age group (39%), followed by 18–30 years (26%), 46–60 years (24%), and >60 years (11%). Males

constituted 54% of the study population, while females accounted for 46%. Most participants were urban residents (62%), with the remaining 38% from rural areas. Regarding educational status, the largest proportion had secondary education (37%), followed by graduates (34%), postgraduates (15%), and primary education (14%). In terms of occupation, nearly 48% were employed, 21% were self-employed, 19% were homemakers, and 12% were unemployed or retired. Additionally, 36% of participants reported the presence of comorbidities, while 64% had no comorbid conditions. More than half of the participants (52%)

Table 1: Demographic Characteristics of Post-COVID Participants (N = 200)

Variable	Category	Frequency (n)	Percentage (%)
Age Group (years)	18–30	52	26.0
	31–45	78	39.0
	46–60	48	24.0
	>60	22	11.0
Gender	Male	108	54.0
	Female	92	46.0
Residence	Urban	124	62.0
	Rural	76	38.0
Educational Status	Primary	28	14.0
	Secondary	74	37.0
	Graduate	68	34.0
	Postgraduate	30	15.0
Occupation	Employed	96	48.0
	Self-employed	42	21.0
	Homemaker	38	19.0
	Unemployed/Retired	24	12.0
Comorbidities	Present	72	36.0
	Absent	128	64.0
Hospital Admission	Yes	104	52.0
During COVID	No	96	48.0

Table 2: Pearson Correlations between Oral Health and Systemic Health Variables Among COVID-Affected Patients (N = 200)

Variable	DMFT	OHI-S	Gingival Index	Periodontal Status	Health Rating Now	Anxiety Now	Depression Now	Pain Now	Breathlessness Stairs
DMFT	1	.056	.309**	-.180*	.056	.080	.020	-.106	.101
OHI-S	.056	1	.044	.086	-.120	.248**	.311**	.112	-.114
Gingival Index	.309**	.044	1	-.115	-.090	.207**	.010	-.016	.233**
Periodontal Status	-.180*	.086	-.115	1	-.189**	-.140*	-.074	.098	.059
Health Rating Now	.056	-.120	-.090	-.189**	1	.080	-.030	.034	.150*
Anxiety Now	.080	.248**	.207**	-.140*	.080	1	.247**	.180*	.057
Depression Now	.020	.311**	.010	-.074	-.030	.247**	1	.189**	-.233**
Pain Now	-.106	.112	-.016	.098	.034	.180*	.189**	1	-.239**
Breathlessness Stairs	.101	-.114	.233**	.059	.150*	.057	-.233**	-.239**	1

*$p < 0.05$, **$p < 0.01$ (2-tailed)

Table 3: Multiple Linear Regression Predicting Health Rating Among COVID-Affected Patients (N = 200).

Predictor	B (Unstandardized)	SE B	Beta (Standardized)	*t*-value	*p*-value
(Constant)	5.120	0.482	—	10.618	0.000
DMFT	-0.045	0.021	-0.112	-2.143	0.033*
OHI-S	-0.238	0.095	-0.165	-2.505	0.013*
Gingival Index	-0.152	0.084	-0.108	-1.810	0.072
Periodontal Status	-0.264	0.097	-0.162	-2.721	0.007**
Anxiety_Now	0.032	0.041	0.034	0.780	0.436
Depression_Now	-0.021	0.038	-0.024	-0.553	0.581
Pain_Now	-0.014	0.029	-0.018	-0.483	0.630
Breathlessness_Stairs	-0.119	0.034	-0.182	-3.500	0.001**

Model Summary: $R^2 = 0.216$, Adjusted $R^2 = 0.189$, $F(8,191) = 6.54$, $p < 0.001$, *p < 0.05, **$p < 0.01$

had a history of hospital admission during COVID-19 infection, whereas 48% were managed without hospitalization. These findings indicate that the study population primarily consisted of middle-aged, urban, and moderately educated individuals with a considerable proportion experiencing hospitalization during COVID-19.

Table 2 presents the Pearson correlation analysis between oral health parameters and systemic health variables among COVID-affected patients (n = 200). DMFT showed a significant positive correlation with the Gingival Index ($r = 0.309$, $p < 0.01$), indicating that higher dental caries experience was associated with poorer gingival health. A significant negative correlation was observed between DMFT and periodontal status ($r = -0.180$, $p < 0.05$). Oral hygiene status (OHI-S) demonstrated significant positive correlations with anxiety ($r = 0.248$, $p < 0.01$) and depression ($r = 0.311$, $p < 0.01$), suggesting that poorer oral hygiene was associated with higher psychological distress. The Gingival Index also correlated positively with anxiety ($r = 0.207$, $p < 0.01$) and breathlessness while climbing stairs ($r = 0.233$, $p < 0.01$). Additionally, health rating showed a significant negative correlation with periodontal status ($r = -0.189$, $p < 0.01$), indicating that poorer periodontal health was associated with lower perceived health status. Significant correlations were also observed between anxiety and depression ($r = 0.247$, $p < 0.01$) and between pain and depression ($r = 0.189$, $p < 0.01$). Overall, the findings suggest a notable association between oral health parameters and systemic as well as psychological health indicators among COVID-affected patients, highlighting the importance of integrated oral–systemic health management.

Table 3 presents the results of the multiple linear regression analysis, which identified several oral and systemic health variables as significant predictors of perceived health (Health_Rating_Now) in COVID - affected patients. The model explained approximately 21.6% of the variance in Health_Rating_Now (Adjusted $R^2 = 0.189$, $F(8,191) = 6.54$, $p < 0.001$), indicating a moderate but meaningful effect.

Among oral health parameters, DMFT ($\beta = -0.112$, $p = 0.033$), OHI-S ($\beta = -0.165$, $p = 0.013$), and Periodontal Status ($\beta = -0.162$, $p = 0.007$) were significant predictors, demonstrating that higher caries experience, poorer oral hygiene, and worse periodontal health were associated with lower self-rated health. Gingival Index showed a negative trend but did not reach statistical significance ($p = 0.072$).

Regarding systemic and psychological variables, Breathlessness on stairs was a significant predictor ($\beta = -0.182$, $p = 0.001$), showing that patients experiencing greater exertionalbreathlessness reported worse overall health. Anxiety, depression, and pain scores were not statistically significant predictors in this model, suggesting that oral and respiratory factors may have a stronger direct association with perceived health in this cohort.

Overall, these findings highlight the integrated impact of oral and systemic health on the perceived health status of COVID-affected patients and underscore the importance of considering dental health in post-COVID rehabilitation and overall health assessment.

DISCUSSION:

In post-COVID patients, oral health measures were associated with systemic and perceived health status, supporting the oral–systemic health relationship. People with more caries experience typically have worse gingival health, according to a substantial positive association between DMFT and Gingival Index seen in this study. According to Petersen and Ogawa, who emphasized the shared risk factors and common etiological pathways of oral illnesses, this conclusion is in line with the recognized data that poor oral hygiene contributes to both dental caries and periodontal inflammation.[8]

Additionally, the study discovered a positive correlation between OHI-S and anxiety and depression, indicating that oral hygiene practices may be impacted by psychological discomfort. This is consistent with research by Cademartori et al., who found that, especially during the COVID-19 epidemic, mental health issues are linked to poor oral hygiene and a higher risk of oral infections.[9] The positive correlation between the Gingival Index and dyspnea during exertion was one of the study's noteworthy findings. This confirms earlier research that connected respiratory disorders and periodontal disease. According to research by Scannapieco et al., periodontal bacteria can aspirate into the lower respiratory tract and cause systemic inflammation and respiratory illness.[10] This link might be especially important in the situation of COVID-19 because the respiratory system is mostly affected.

DMFT, OHI-S, periodontal condition, and dyspnea on climbing stairs were found to be significant predictors of self-rated health status using multiple linear regression analysis. These results align with the research conducted by Larvinet al.[11], which found that poor periodontal health was linked to a higher chance of catastrophic COVID-19 outcomes, potentially through systemic inflammatory pathways. Similarly, Marouf et al. discovered a strong correlation between periodontitis and COVID-19 consequences, such as an elevated likelihood of intensive care hospitalization and the requirement for assisted ventilation.[12]

It's interesting to note that psychological factors like despair and anxiety did not significantly predict subjective health in the regression model, indicating that their impact may be indirect. The regression model highlighted the importance of other factors like socioeconomic position and healthcare access while explaining 21.6% of the variance in self-rated health, demonstrating a moderate impact of oral and systemic variables.

Overall, the results highlight the strong correlation between systemic symptoms and perceived health in COVID-19 patients and poor oral health, including periodontal disease and oral hygiene status. These findings highlight the significance of using a multidisciplinary approach and incorporating oral health assessment into post-COVID care in order to enhance overall health outcomes.

CONCLUSION:

The present study demonstrated a significant relationship between oral health status and systemic health variables among COVID-affected patients. Poor oral health indicators, including higher DMFT scores, poorer oral hygiene (OHI-S), and worse periodontal status, were associated with lower self-rated health status. Additionally, breathlessness while climbing stairs emerged as an important systemic predictor of perceived health. The findings emphasize that oral health is closely linked with overall systemic health in post-COVID individuals, highlighting the need for integrated oral and medical care in post-COVID management.

LIMITATIONS:

The present study has certain limitations that should be considered while interpreting the findings. The cross-sectional design limits the ability to establish a causal relationship between oral health and systemic health variables. The study was conducted among a limited sample of post-COVIDparticipants, which may affect the generalizability of the results to other populations. Additionally, some systemic and psychological variables were self-reported, which may introduce recall or reporting bias. Furthermore, the study did not assess long-term effects of COVID-19 on oral health, and other potential influencing factors such as dietary habits, oral hygiene practices, and medication history were not extensively evaluated.

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Conflicts of Interest

There are no conflicts of interest.

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