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**Dr. Anu Radha**  
Postgraduate Student,  
Department of Periodontics,  
IGGDC, Jammu, University of  
Jammu, Jammu and Kashmir,  
India

**Dr. Manik Sharma**  
Professor and Head, Department  
of Periodontics, IGGDC, Jammu,  
University of Jammu, Jammu  
and Kashmir, India

**Parmita Sharma**  
Student, Department of  
Psychology, Daulat Ram  
College, University of Delhi, New  
Delhi, India

**Corresponding Author:**  
**Dr. Anu Radha**  
Postgraduate Student,  
Department of Periodontics,  
IGGDC, Jammu, University of  
Jammu, Jammu and Kashmir,  
India

## Concealed connection between COVID-19 infection and periodontitis: A survey in Jammu population

**Dr. Anu Radha, Dr. Manik Sharma and Parmita Sharma**

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### Abstract

**Introduction:** On 11 March 2020, WHO has declared COVID-19 infection a worldwide pandemic as it had severely affected almost every country in the world? Many researchers have given cytokine storm as the basic pathogenesis for COVID 19 complications. Interestingly, Periodontal Disease (PD) is also an inflammatory disease and cytokines play a major role in disease progression. The aim of this survey is to assess the prevalence of gum diseases among COVID 19 patients prior to getting infection.

**Methodology:** This patient's self-assessed survey was created and administered a 32-item questionnaire for COVID positive patients. All questions were framed with the help of various standard national and international guidelines and information available at the time of survey.

**Result:** Out of 400 questionnaire forms, we received 376 responses and out of 376 we excluded 74 partially filled responses. 73.2% had gum diseases prior to COVID-19 and 55% had mobile teeth prior to COVID-19.

**Conclusion:** There can be definitely an impact of periodontal diseases on progression and complication of COVID-19 and vice-versa. Knowing Periodontal Disease and it's pathogenic (inflammatory) link with COVID-19 infection would help in identifying the risk groups and establish apropos recommendation.

**Keywords:** COVID-19, cytokine storm, inflammatory mediators, periodontal disease

### Introduction

In 2019 in Wuhan city of China, Severe Acute Respiratory Syndrome Coronavirus-2 was first time discovered disastrously spreading globally resulting in worldwide pandemic. SARS-CoV-2 belongs to Coronaviridae family <sup>[1]</sup>. This contagious and menacing respiratory tract infection has resulted in over 340 million confirmed cases in world and 38 million confirmed cases in India and almost 5 million deaths as of 18<sup>th</sup> Jan, 2022 (WHO). COVID-19 has detrimental effect on the lungs and other organs <sup>[2, 3]</sup>. Mostly In patients suffering from COVID-19 have mild symptoms howbeit some patients could develop serious illness like pneumonia, pulmonary edema, acute respiratory distress syndrome (ARDS), multiple organ dysfunction syndrome, or even die <sup>[2, 4, 5]</sup>.

Periodontal disease (PD) is a group of chronic inflammatory diseases, including gingivitis and periodontitis <sup>[2, 6, 7, 8]</sup>. It is an infectious, polymicrobial (Dysbiotic event) and multifactorial disease known to be caused by multiple microbial and host inflammatory interactions that affect periodontal health as well as have systemic implications. According to the World Health Organization (WHO), PD affects about 10% of population globally and it is the sixth most prevalent disease affecting the world population. Periodontal disease has long been accounted as a silent pandemic. The pathogenesis of PD involves chronic inflammation which leads to increase in inflammatory mediators and acute phase proteins(C-RP) <sup>[9]</sup>.

The hitching between Periodontal Disease and severe COVID-19 illness could be because of overlapping of inflammatory process and risk factors among these infections (Figure 1). Most comorbidities and risk factors reported in patients with severe COVID-19 also aggravate the development of PD. The two main factors in Pathogenesis of Periodontal diseases are the bacterial products for evasion of host immune system and host immune inflammatory reaction. PD could lead to extension of inflammatory response to systemic level resulting in increased inflammatory mediators which in turn exacerbate COVID-19 infection outcomes.

Co-infection of Periodontal pathobionts and the SARS-Cov-2 virus will lead to exasperate inflammatory response (cytokine storm) [10].

Many pathophysiological mechanisms have been purposed to describe COVID-19 behaviour. The one with most relevant is that its symptoms seem to be related to a ‘cytokine storm’ which exhibits itself as elevated serum levels of IL-1 beta, IL-7, IL-10, IL-17, IL-2, IL-8, IL-9, GM-CSF, G-CSF, IFN-gamma, TNF alpha, MIP1A, MIP1B, MCP1 and IP10<sup>9, 11</sup>. Patients in intensive care unit have shown increased levels of this inflammatory mediators [11] despite cytokine and inflammatory mediators, Th-17 inflammatory pathway is also a common connection between the two [12, 13]. Thus, this survey was designed to investigate a possible association between COVID-19 and the presence of periodontitis.

**Materials and Methods**

This survey was conducted after obtaining relevant permissions from the Scientific Advisory Committee and Institutional ethics committee Indira Gandhi Govt. Dental College Jammu. Patients visiting the dedicated COVID Outpatient Screening Department (OPD) of the institution for the diagnosis of COVID-19 were recruited for the study and the COVID positive patients were communicated by the research team regarding their consent for participation in the survey after their recovery. This survey was conducted between September 2020 and December 2020. Individuals aged between 20-50years and who had at least 20 teeth in the oral cavity were included in the survey. A 32-item Self-administered structured questionnaire was formulated. All questions were framed with the help of various standard national and international guidelines and information available at the time of survey. Section 1 of questionnaire comprised of demographic information, section 2 was comprised of COVID related questions and section 3 was comprised questions of symptoms of periodontal diseases, awareness in public about relation between vitamin deficiencies and Periodontal diseases and awareness about effect of general health status on oral health. One investigator was assigned in the outpatient department of periodontics for assistance in filling up of questionnaire form. A total of 400 patients having recent history of COVID infection were provided with the questionnaire and 74 partially filled questionnaire forms were excluded. This survey was conducted between September 2020 and October 2020.

**Results**

Data obtained was entered in Microsoft Excel 2010. Frequency and descriptive analysis were done by using Statistical Package for Social Sciences SPSS software. A total of 302 fully filled responses were computed for analysis. Table 1 contains demographic data, table 2 contains data about COVID 19 particulars and table 3 contains data on periodontal diseases prior to COVID 19; awareness about relation between periodontal diseases and nutrition (vitamin) in bleeding gums and awareness about relation between general and oral health. Among all participants, 53% were males and 47% were females. In this survey, we found 88.1% had dental related problems prior to COVID 19 infection. 72.2% participants had claimed that they had maintained their oral hygiene during COVID 19. 73.2% had periodontal diseases prior to COVID 19 infection. 49.7% had bad breath problem prior to COVID 19 infection and 23.2% had worsening of bad breath during/after COVID 19 infection. 55% had mobile teeth prior to COVID 19 infection. While comparing the presence of dental related problems prior to COVID 19 infection and ventilator or oxygen support while COVID infection it was found statistically significant.

**Table 1:** Demographic data

S. No.	Variables	Frequency	Percentage
1.	Sex		
	Male	160	53.0
	Female	142	47.0
2.	Age		
	25-40 years	78	25.8
	40-50 years	115	38.1
	50years & above	109	36.1
3.	Weight		
	Less than 45 kgs	5	1.7
	45kgs-60kgs	97	32.1
	60kgs-75kgs	153	50.7
	More than 75kgs	47	15.6
4.	Qualification		
	Pre-secondary level	64	21.2
	Higher secondary level	122	40.4
	Bachelor and other higher level	116	38.4

**Table 2:** Frequency and percentage of presence of COVID infection symptoms’, comorbidities and ventilator/ oxygen support in survey population.

S. No.	Questions	Variables	Frequency	Percentage
1.	COVID 19 Symptoms	Present	236	78.1
		Absent	66	21.9
2.	Comorbidity	Present	169	56.0
		Absent	133	44.0
3.	Ventilator/oxygen support	Present	159	52.6
		Absent	117	38.7

**Table 3:** Frequency and percentage of various periodontal health and disease questions asked during survey in test population.

S. No.	Questions	Variables	Frequency	Percentage
1.	Dental problems prior to COVID 19	Present	266	88.1
		Absent	36	11.9
2.	Oral hygiene maintenance during COVID 19	Maintained	218	72.2
		Not maintained	84	27.8
3.	Smoking	Present	159	52.6
		Absent	143	47.4
4.	Gum diseases prior to COVID 19	Present	221	73.2
		Absent	81	26.8
5.	Bad breath prior to COVID 19	Present	150	49.7
		Absent	152	50.3
6.	Worsening of bad breath during/after COVID 19	Present	70	23.2
		Absent	105	34.8
7.	Mobile tooth/teeth prior to COVID 19	Present	166	55.0
		Absent	136	45.0
8.	Worsening of mobile teeth during/after COVID 19	Present	35	11.6

		Absent	166	55.0
9.	New site/sites of gum bleeding during/after COVID 19	Present	55	18.2
		Absent	247	81.8
10.	Awareness about gum diseases	Aware	56	18.5
		Not aware	246	81.5
11.	Awareness about importance of nutrition (vitamins) in bleeding gums	Aware	86	28.5
		Not-aware	216	71.5
12.	Awareness of relation between general health and oral health	Aware	106	35.1
		Not aware	196	64.9

## Discussion

To best of our knowledge at the time of this survey, it was the first survey of its kind that analysed the Periodontal disease among COVID 19 patients prior to infection. The main inference of this survey that periodontal diseases also partake common risk factors with most chronic inflammatory diseases which are known to influence COVID-19 severity [14, 15]. From various studies, the association between periodontal diseases and systemic health is quite evident [16] and also its independent association with increased risk of most chronic non-communicable diseases (NCDs) [17], such as cardiovascular diseases (CVD) [18, 19] diabetes [20, 21, 22] hypertension [23]; chronic renal disease [24], pneumonia [25] and cancer [26]. A systematic review in 2021 has reported the interrelation of Periodontitis and increased risk of mortality, specifically, in association with cerebrovascular diseases, cardiovascular diseases and cancer [27]. In 2020 Schenkein *et al.* have explained these associations based on involvement of common inflammatory pathways, environmental and genetic risk factors [28]. As COVID -19 is a novel infection and knowledge about its pathogenesis is still in infancy phase, various hypotheses are put forth. Many of these hypotheses are explaining the association of periodontal diseases and COVID-19 infection because of common inflammatory pathways involved (cytokines). A study by Takahashi *et al.* in 2020 has suggested aggravation of COVID-19 on aspiration of periodonto-pathogenic bacteria as these bacteria will induce expression of angiotensin-2 converting enzyme (which is a receptor for SARS- COV-2) and also increase inflammatory cytokines in lower respiratory tract [29]. Another study by Balaji *et al.* 2020 had suggested the enhancement of SARS-COV-2 virulence by periodonto-pathogenic bacteria<sup>30</sup> and role of periodontal pockets as a viral reservoir in the oral cavity [31, 32, 33, 34, 35]. Further one more common link explored between the pathogenesis of COVID-19 and periodontal diseases is Neutrophil Extracellular Trap (NET) [35]. In 2020 Sahni put forth a hypothesis of inflammatory connection (Cytokine Storm) between Periodontitis and COVID-19 infection. One of its rarest study by Patel and Woolley<sup>37</sup> has propounded increased necrotizing periodontal disease during COVID-19 pandemic.

## Conclusion

As a chronic inflammatory disease, periodontitis has previously linked up with many systemic concerns and it can have effect on COVID-19 Infection also. This survey has clear limitations and the results need to be taken with caution. As the participants self-assessed themselves; it might be a cause of variation in result. Also, this survey was limited to a small population in one particular area. In future, more studies including clinical examination and larger population group are required to validate and further elucidate the concealed connection between periodontal health status and COVID 19 progression.

In future, more focus should be on interventional studies which include measurement of clinical parameters and effect

of periodontal therapy on COVID-19 infection. This would help to better understand the concealed connection that is existing between them.

## Conflict of Interest

Not available

## Financial Support

Not available

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