ORIGINAL RESEARCH

Exploring the correlation between covid-19 and periodontal diseases-An original research

[1]Dr.Dnyaneshwari Gujar, [2]Dr. Chaitrali Joshi, [3]Dr. Devarshi J Pandya, [4]Dr. Kedar Nath Nayak, [5]Dr.Mohammad Baba Shafiuddin, [6]Dr. Sheik Sameerudeen, [7]Dr. Akriti Mahajan

[1]Associate Professor, [2]PG Student, Department of Periodontology, Dr.D.Y.Patil Dental College and Hospital, Dr.DY Patil Vidyapeeth Pune, Maharashtra, India
[3]PG Resident, Department of Periodontics and Implantology, NIMS Dental College, Jaipur, Rajasthan, India
[4]Associate Professor, Department of General Surgery, Government Medical College and Hospital, Sundargarh, Odisha, India
[5]Associate Professor, Department of Public Health Dentistry, Mamata Institute of Dental Sciences, Bachupally, Hyderabad, Telangana, India
[6]BDS, MDS, Consultant Oral and Maxillofacial surgeon, MSM Dental and Maxillofacial Centre, Adirampattinam, Tamilnadu, India
[7]MDS, Oral Medicine and Radiology, Private Consultant, Jammu and Kashmir, India

Correspondence:
Dr. Kedar Nath Nayak
Associate Professor, Department of General Surgery, Government Medical College and Hospital, Sundargarh, Odisha, India
Email: bluebaby140485@gmail.com

ABSTRACT
Aim: Purpose of the present research was to assess the co-relation between covid-19 and periodontal disease.
Methodology: A case-control study was conducted amongst 150 participants. Patients who had positive real time reverse transcription polymerase chain reaction results for severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection were included in the case group (n = 79), and patients with negative results were included in the control group (n = 71). The periodontal examination involved recording the plaque scores, calculus scores, tooth mobility, gingival bleeding, probing depth, recession, and clinical attachment level (CAL).
Results: Logistic regression analysis showed significant associations of mean plaque scores ≥ 1 (odds ratio (OR), 7.01; 95% confidence interval (CI), 1.83 to 26.94), gingivitis (OR, 17.65; 95% CI, 5.95 to 52.37), mean CAL ≥ 2 mm (OR, 8.46; 95% CI, 3.47 to 20.63), and severe periodontitis (OR, 11.75; 95% CI, 3.89 to 35.49) with COVID-19; these findings were more prevalent in the case group.
Conclusion: Based on the above mentioned observations, it can be concluded that there is an association between periodontitis severity and COVID-19. Gingival bleeding and dental plaque accumulation are also more frequent among COVID-19 patients. Hence, it is essential to maintain periodontal health and good oral hygiene as an important measure for COVID-19 prevention and management.
Keywords: clinical attachment level, coronavirus, COVID-19, oral health, oral hygiene, periodontitis, SARS-CoV-2.

INTRODUCTION

Coronavirus disease 2019 (COVID-19), due to SARS-CoV-2, is the most pressing and emergent health problem worldwide. While most cases result in mild symptoms (including hyposalivation and an alteration in taste), some cases progress to severe pneumonia and multi-organ failure with the death of the patient, according to the age and the presence of comorbidities.[1] Recent relevant studies have demonstrated the bidirectional association between the severe clinical course of COVID-19 and chronic diseases such as: cardiovascular disease, hypertension, diabetes mellitus, obesity and chronic renal disease.[2] In seeking a link between COVID-19 and these chronic diseases, they are garnering worldwide interest in the field of research. This interest may also be extended to include more common, chronic oral diseases in adults, such as periodontitis, with already demonstrated correlations and associations with other chronic diseases, as mentioned above.[3] The authors in this perspective article will report the most recent references of interest regarding COVID-19 and periodontal physiopathology in order to improve our understanding of associated or randomly associated factors. Data from the literature has confirmed that the majority of COVID-19 positive patients are male. And male sex was observed to be an independent risk factor, which was associated with refractory disease and death (2.8 % death rate for men vs. 1.7 % for female).[4,5] With reference to the hypothesis in this article concerning the association between periodontal pathophysiology and COVID-19, let us begin with the argumentation of the studies showing that SARS-CoV-2 also enters the human body via the oral mucosa through the Angiotensin Converting Enzyme II (ACE2) receptor, which is highly expressed in the oral mucosa (mostly in the epithelial cells of the tongue) and in the salivary glands.[6] A study by Pascolo et al. has demonstrated the necessary co-expression of ACE2 and trans-membrane serine protease (TMPRSS2), to enable the entry of SARS-CoV- 2 into host cells.[7-10] Indeed, the TMPRSS and furin serve to cleave the virus S protein and thereafter spread the infection.[11] Recently, preliminary data has speculated a new infection route for SARS-CoV-2, in which this virus could use its spike protein to bind to CD147 in order to infect human cells.[12-15] In support of the hypothesis outlined in this article, this would, therefore, result in a high expression of CD147 in the epithelial cells, particularly those of the oral mucosa.[16] Additional data lending credence to the speculation in this article is that SARS-CoV-2 resides in saliva and nasopharynx in such quantities so as to render swabs with these samples useful for COVID-19 diagnostic tests.[17] Furthermore, a recent study by Gupta et al. has demonstrated the presence of SARS-CoV-2 in gingival crevicular fluid (GCF), with a sensitivity of the diagnostic swab of 63.64 % (a salivary swab has a sensitivity of approximately 64 %).[18] Hence, the fact that SARS-CoV-2 stagnates in the GCF may lead us to conclude that poor oral hygiene may increase the viral load in the oral cavity. Two possible mechanisms which could explain the association between periodontitis and the COVID-19 disease are: (1) the direct contact of virus with the periodontal tissues, also due to the high expression of ACEII and CD147, as mentioned above; and/or (2) the similar overexpression of several cytokines, a COVID-19 'cytokine storm', with elevated serum levels of IL-1 beta, IL-6, IL-7, IL-10, IL-17, IL-2, IL-8, IL-9, GM-CSF, GCSF, IFN-gamma, TNF alpha, MIP1A, MIP1B, MCP1 and IP10.[19,20]Currently, limited clinical data are available regarding the association between COVID-19 and periodontitis.

AIM OF THE PRESENT STUDY

Purpose of the present research was to assess the co-relation between covid-19 and periodontal disease.

METHODOLOGY

The present study was conducted as a case-control study was conducted at our institution during the period from January 2021 to November 2021. Patients visiting the dedicated COVID Outpatient Department (OPD) of the institution who had undergone real-time reverse transcription polymerase chain reaction (rRT-PCR) for the diagnosis of COVID-19 were recruited for the study. Patients who had positive rRTPCR results were included in the case group, and patients with negative results were included in the control group. Individuals aged 18 and above who had at least 20 teeth in the oral cavity were included in the study. The following study variables were recorded: age, sex, presence, or absence of symptoms on visiting the COVID OPD, presence or absence of any systemic diseases, tobacco consumption status (smoking and smokeless; categorized as current user, former user, or never user), and oral hygiene habits (types of oral hygiene aids and frequency of daily oral hygiene practice). This was followed by a complete periodontal examination during which the dentition status was recorded, followed by the recording of plaque scores, calculus scores, tooth mobility, gingival bleeding, probing depth (PD), recession (REC), and clinical attachment level (CAL). Plaque and calculus scores were recorded in all the teeth per the plaque index criteria of Silness and Loe [21] and the calculus component of the simplified oral hygiene index of Greene and Vermillion,[22] respectively. The mean values of PD, REC, and CAL, and mean percentage of interproximal sites with various thresholds for periodontal disease (PD ≥ 4 mm, PD ≥ 5 mm, CAL ≥ 3 mm, CAL ≥ 4 mm, CAL ≥ 6 mm) were compared between the two groups. The study protocol was approved by the Human Ethics Committee of the institution, and the study was conducted in accordance with the Helsinki Declaration as revised in 2013. Written informed consent in a language suitable for the participants was obtained from all the prospective study participants. All categorical variables were analyzed using the chi-square test, and continuous variables were expressed as mean and standard deviation and were analyzed using Student's t-test. The associations of COVID-19 with poor oral hygiene, gingival bleeding, and periodontal disease were determined using a logistic regression model adjusted for variables that were found to be significant in the univariate analysis.

RESULTS

Of a total of 196 patients who were provided with an explanation regarding the purpose of the study, 167 agreed to participate in the study. Nine patients were excluded as they had fewer than 20 teeth, whereas eight participants opted out because of discomfort during the periodontal examination. Among the 150 participants who had complete sets of data, 79 were categorized as cases and 71 as controls. Although the age of the participants with COVID-19 was significantly higher than that of the controls, the two groups did not differ significantly in terms of sex distribution, medical history, and tobacco related habits. None of the study participants reported a history of cardiovascular or renal diseases. Participants with COVID-19 had significantly higher mean values of plaque scores, number of mobile teeth, gingival bleeding scores, PD, REC, and CAL compared to the controls. The mean percentages of inter-proximal sites with PD ≥ 4 mm, PD ≥ 5 mm, CAL ≥ 3 mm, CAL ≥ 4 mm, and CAL ≥ 6 mm were also significantly higher in the case group than in the control group. Analysis showed significant associations of COVID-19 with mean plaque scores ≥ 1 (odds ratio (OR), 7.01; 95% confidence interval (CI), 1.83 to 26.94), gingivitis (OR, 17.65; 95% CI, 5.95 to 52.37), mean CAL ≥ 2 mm (OR, 8.46; 95% CI, 3.47 to 20.63), and severe periodontitis (OR, 11.75; 95% CI, 3.89 to 35.49) after adjusting for age and the frequency of oral hygiene practices. (Table 1&2)

Table 1- Proportion of study participants with various thresholds of disease in the case and control groups

Variable (No./Percentage)	Case group (n = 79)	Control group (n = 71)	P *
Plaque score ≥ 1	19 (24.1)	3 (4.2)	0.001
Gingivitis	74 (93.7)	36 (50.7)	< 0.001
Mean CAL ≥ 2 mm	51 (64.6)	15 (21.1)	< 0.001
Severe periodontitis	39 (49.4)	7 (9.9)	< 0.001

*CAL, clinical attachment level. *Chi-square test*

Table 2- Logistic regression after adjusting for age and frequency of oral hygiene practices

Variable	OR	P	95% CI
Plaque score ≥ 1	7.01	0.005	1.83-26.94
Gingivitis	17.65	< 0.001	5.95-52.37
Mean CAL ≥ 2 mm	8.46	< 0.001	3.47-20.63
Severe periodontitis	11.75	< 0.001	3.89-35.49

CAL, clinical attachment level; CI, confidence interval; OR, odds ratio.

DISCUSSION

The findings of our study revealed that periodontitis is significantly associated with COVID-19. Periodontitis is a multifactorial disease leading to the destruction of the supporting structures of the teeth, and its association with systemic conditions has been widely studied.[23] COVID-19 has been shown to be more severe among patients with comorbidities, such as diabetes, cardiovascular diseases, and renal diseases.[24] Oral dysbiosis resulting from increased dental plaque in periodontitis may provide an environment for the oral carriage of respiratory pathogens, thereby causing COVID-19-related complications. In a systematic review, Scannapieco et al. concluded that there was a significant association between poor oral hygiene and nosocomial pneumonia.[25] Periodontitis has been linked with both COPD and pneumonia either by the direct aspiration of oral pathogens into the lungs or by the alteration of mucous surfaces in the respiratory tract, promoting adhesion, and the invasion of pathogens.[26] This may also aids in explaining the association between periodontal disease and COVID-19 observed in the present study. However, as this was an initial study, the data that were generated may be used for directing future research with improved methodology and with a larger sample size in order to better understand the association between periodontitis and SARS-CoV-2 infection.

CONCLUSION

Within the limitations of this case-control study, it can be concluded that there is an association between periodontitis and COVID-19. The increased prevalence and severity of periodontitis and associated poor oral hygiene might contribute to the aggravation of SARS-CoV-2 infection.

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